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NATURAL HISTORY

THE JOURNAL OF THE
AMERICAN MUSEUM OF NATURAL HISTORY

VOLUME XXXV

January-May, 1935

TEN ISSUES A YEAR

Published by

THE AMERICAN MUSEUM OF NATURAL HISTORY
NEW YORK, N. Y.

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NATURAL HISTORY—Publication Office, 10 Ferry Street, Concord, New Hampshire
Subscriptions should be addressed to The Treasurer, The American Museum of Natural History, 77th Street and Central Park West, New York, N. Y. NATURAL HISTORY is sent to all members of the American Museum as one of the privileges of membership, \$2.10 of the annual amount received from each membership being applied to the year's subscription to the magazine. GEORGE L. ALPERS, Advertising Manager, Advertising Office, The American Museum of Natural History, 77th Street and Central Park West, New York, N. Y. Copyright, 1935, by The American Museum of Natural History, New York



Courtesy of the U. S. Steel Corporation

The Age of Iron

Within the past hundred years the smelting of iron and the production of steel have grown into one of mankind's major activities. Where formerly iron and steel were very widely used, but in small quantities, they are now produced in gigantic quantities and used everywhere. The converter shown in this photograph is transforming iron into steel

(See "Iron," Page 17)

NATURAL HISTORY

January, 1935

Witchcraft Among the Zulus

So firmly do the Zulus believe in the supernatural power of witches and witch-doctors, that witchcraft seems to play an actual as well as an imaginary part in their everyday lives

by Carl von Hoffman

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THOUGH long acquainted with white men, and influenced in countless ways by civilization, the Zulu still clings to his belief in the supernatural powers of witches and witch-doctors, who play a large part in the life of Zululand.

One who has lived with these folk can understand the spell of their spirit world. The semi-tropical sun throws bright high-lights and casts deep shadows. The distant vistas are filled with mirages. There is the danger of snakes and lurking beasts, and the spell cast by mystifying nights. The effect of all this is so strong that even the white man may find it difficult at times to keep his balance.

It is a perfect setting for the native with his world of spirits, good and evil—a world largely controlled by hovering ancestors and adverse spirits. The closeness of primitive existence to nature gives a supernatural meaning to almost every detail of life. Any elephant or lion may be an embodied spirit, while the venomous snake is regarded as a reincarnated ancestor, to be worshiped and protected as such. Even the shadows cast at night by trees conjure up to the native mind a world of treacherous spirits seeking to destroy him. Thus his main occupation is the appeasement of his ancestral and other spirits. Disease, misfortune, and death are attributed to them, and to those who invoke such spirits by witchcraft.

In Zulu the word *Abatakati* means witch, and the word *Ungoma* signifies a witch-doctor, but to the native mind there is a world of difference between them. The witch-doctor functions as a distinguished member of the community, the witch as an outlaw. Both deal in the occult, but the witch invokes evil spirits for his designs, while the witch-doctor drives them away.

The rôle of the witch-doctor is that of guardian against witches and evil spirits. He tells the villagers how to fulfill their destiny, and he cures by driving the malignant spirit out of the sick body. He divines the cause of people's troubles and smells out forbidden deeds. As a dealer in the occult he can bring good or bad luck, or death. From the white man's viewpoint he is also a sinister power who brings about ritual murder, but to the native he remains an oracle whose findings and omens are almost infallible.

The witch invokes adverse spirits and deals in black magic. He deals in things evil, and he casts spells which bring misfortune, disease, and death. A witch will come in handy when a native wants protection or revenge, but he is also a dispenser of charms, and as such carries on a lively, if underhand, trade with the natives. He sells them advice, medicines, and love potions, and tells fortunes. But any dealings with the witch are somewhat risky, since a person otherwise innocent may fall under the spell of the witch and may become suspected of



A Zulu chief and his retinue. The fourth figure from the right is the chief's official witch-doctor, while the woman, second from the right, is a witch, influential but nevertheless unofficial except in time of war, when she is called upon to bewitch the enemy



A Zulu wearing the skin of a buzzard, which the wearer believes has certain magic forces that tend to make the owner more influential or distinguished

A Zulu bride with her father. She carries a spear, a dancing shield, and a stick, and is veiled to hide her from adverse spirits. The bladders of sacrificed sheep or goats that she wears in her hair are a sign that sacrifices have been made to her ancestral spirits



A phonograph—white man's "medicine" or magic—contains, so the Zulu believes, the resurrected body of a human being shrunk by magic to miniature size, but still able to speak. The natives are mystified as to what the unfortunate creature feeds on



practicing witchcraft himself. The natives may laugh at the witch when he comes in to the kraal to tell fortunes, but they go in awe and even fear when they seek him out for some hidden purpose. The witch for his part plies his trade under cover of darkness, for detection may mean his end.

PROFESSIONAL AND CASUAL WITCHES

There are all sorts of witches of both sexes, but practically all fall into two main categories: the professional and the casual. When a Zulu speaks of a witch, he is thinking of a professional witch, of a person who spends his time in black magic and whose services can be had at a price. This person may live openly as a typical native, occupied with the usual daily village routine. There is the usual family life, although in the case of the male witch there may be more wives because he can afford to buy more. Sometimes a reputed witch had to be pointed out to me, since he couldn't be picked out of a crowd, but more often he stood out by his eccentric hair-dress or by the extra number of ornaments tied about his body. Other witches are recluses, living apart from the villagers, often pretending poverty or posing as beggars. The witch belongs to no guild such as that of the witch-doctors, but the craft is usually handed down as a family tradition.

The casual witch is a common event. He may be any person accused through malice or hearsay, or a person who has committed an act of witchcraft for some personal reason. Every Zulu man, woman, or child lives in constant fear of being accused of witchcraft. Anything that deviates from the normal routine of life is attributed to evil spirits or witchcraft, and the native constantly goes about with the words witch and bewitched on his mind, although he is very reluctant to utter the words. But the words come out too often, and tragedy follows.

Typical of what goes on continually is the case of an old woman in the Impangei district. At the white trader's post where I

spent the night I heard that the natives up the hill were out in the bush looking for a witch. The next day I got the details. Two old women had been quarreling over some tobacco, and afterward the aggrieved one was heard to mutter something about the other being an old witch. Some time later she took sick with a cold and let it be known she had been bewitched. When asked who had bewitched her, she accused the other woman. The sick woman died, probably of pneumonia, but to the natives all evidence pointed to witchcraft. The accused woman, knowing what was in store for her, cleared out into the bush. Had she remained, she would have been tried before a witch-doctor and probably put to death. That she ran away was sufficient proof to the natives that she was guilty. As for the old woman, death was more or less certain whether at the hands of the natives or by prowling beasts of the bush.

The professional witch operates in devious ways. Much of this is through suggestion, with a great play on local superstitions. If a Zulu, on awakening, finds something smeared on his neck, he knows that a witch has marked him for death. More common is the placing of sticks, fetishes, or medicines in the doorway of a marked man. In such cases fear and brooding by the victim often lead to death. He may run to the witch-doctor, who may help him with potions that ward off the evil influence, or may divine the guilty witch and in that way put a stop to the influence. The fear of being possessed makes the native suspicious of any unusual act.

THE WHITE MAN'S MAGIC

On one of my early trips to Zululand I entertained a chief with the usual conjuring tricks, and among other things I made a coin disappear and then produced it again from off the bare leg of a native. The effect was quite unexpected. The native was frightened and grave doubts were raised among the rest as to whether he was bewitched and his soul enslaved by an evil force. It took some explanation to reassure them that the white



Wova, a chief of the Zulu tribe, seated in his kraal. The huts are constructed of bent twigs supported by two center poles, and the walls are thatched with grass, bound together with bark



A consultant. This Zulu native, having presented a gift to the witch in whom he has faith, has seated himself in order to a wait her pleasure before relating his difficulties



A bride (on the right) taking her ritualistic bath before her marriage. The Zulu bride is always purchased for thirteen cattle, and both before and after the ceremony the local witch-doctor is apt to play an important part, his purpose being to drive away adverse spirits or to keep others friendly

Rites and



A Zulu chief points with his war club, or knob-kerry, to the distant hills, where the spirits of the dead "impis" or regiments sway in the moonlight with the cornstalks



Fear is constantly felt that food and drink may have been subjected to witchcraft, or may actually be poisoned. Every chief, therefore, is constantly on the alert for these dangers, and employs an official tester—one of whom is shown drinking from the chief's bowl before the chief himself indulges

Ceremonies

The dancing bridesmaids sweep the air with their brooms, war clubs, and spears in order to drive off any evil spirits that may have designs upon the bride



man's magic could not affect a Zulu. Once assured, the native asked for the coin, since it had come from his leg and therefore must be his.

It is through potions that the professional witch does most of his work. Potions are used for almost everything—to attract, protect, bring luck, and kill. Poisoning is a well-developed art in Zululand as throughout Africa, and the venom comes from herbs, leaves, and snakes. Each witch is supposed to have his own secret formulas. Poisoning is common, but its fatal consequences are invariably attributed to the evil spell invoked by some witch. The fear of the evil spell is especially noticeable at meals. No food is served without assuring the guest that no evil spell or poison has been placed in the food. For the chief there is always the tester who tastes first of everything served. In drinking from the common beer pot, the chief, and each guest in turn, drink only after the tester has taken a few gulps before them. There are also legendary poisons, some of which may produce effects by power of suggestion. A common sight, when a leopard has been shot, is to see the natives pluck out the whiskers of the animal. Leopard whiskers are both feared as an evil potion and treasured as a medicine. When put into food, they are supposed to produce nausea and death, but when mixed with the flesh of the animal, the result is a healthful dish which produces great courage.

SUSPICIOUS SHADOWS

Tricks and deceptions of various sorts are also resorted to by the professional witch. Ventriloquism is a well-developed art among Zulu witches, and is sometimes worked in conjunction with silhouettes. In one instance I know of, a shadow having the outlines of some wild beast with moving jaws, fell across a kraal, and a voice was heard calling. The natives rushed out of their huts to see a shadow trying to swallow a cow, and heard a voice demanding that the best cow be driven off to a ravine and left there for a hungry spirit. The natives sometimes obey

such a voice, but on this occasion, they lit fires and stood guard against the evil spirit. The next morning they called on the witch-doctor that he might divine whether it was an evil spirit or a witch. As usual, the witch-doctor knew that it was not *Amadhlozi*, a spirit, but a witch throwing a silhouette by moonlight, probably from a near-by tree, or that it might even be the shadow of a tree swaying in the wind and made use of by a witch. As usual, he knew who the witch was, but still went through the process of smelling out the guilty one.

The tactics of the professional witch are also attributed at one time or another to the casual witch. A native may have his cow go dry, and having dreamt that a certain person had evil designs on his cattle, he thereupon accuses that person of having bewitched his cow. The accused person may not even deny it, since he may feel he has no control over his soul while asleep, and so lets the witch-doctor divine the "truth," after perhaps presenting him with a goat as a present. If guilty, he may have to replace the cow, and a stigma falls on him which makes his future hazardous.

A man may also function as a casual witch if, for instance, he makes use of a love-charm without first making some sacrifice, such as slaughtering a goat for his ancestral spirits. There was the incident of the native who had gone hunting with a love-charm and had managed to bring back a buck. Later, a friend died, and it was rumored that this had been caused by the hunter failing to make the necessary sacrifice.

The casual witch may even be accused of stealing souls and thus be put in the class of a professional witch. The Zulu buries his dead within the kraal, near his huts, for fear that the bodies may be dug up by witches. It is firmly believed that witches resurrect corpses stolen from graves, shrink them into dwarfs, and use them as their agents. The enslaved soul thus becomes an instrument of evil under the command of a witch. On one occasion a hyena was driven off while digging up a fresh grave. No one could con-



Dispelling The Evil Spirits

The Zulu believes that evil spirits lurk everywhere, but especially where there is an attractive bride. Numerous bridesmaids, therefore, participate in nuptial ceremonies, and it is their duty to protect the bride from these spirits. For two days before the wedding the bridesmaids indulge in a beer feast and compose songs to the groom



Married women. The headdress is woven of their own hair, and is taken down only when they are in mourning for a relative



A Zulu mother guards her child carefully against any "evil eyes." An admirer, looking at this pretty little girl, will remark "What an ugly boy you have," in order to mislead any adverse spirit that may be lurking about

In the Land





A Zulu witch, ignorant, no doubt, but nevertheless both influential and awe-inspiring among her people

A Zulu chief in full regalia. The leopard-skin collar and necklace of leopard's claws and teeth, worn only by the chiefs, is supposed to endow them with the ferocity of this beast



of Witches



At the left is a Zulu warrior in full regalia trying to procure a love potion from a witch. Oddly enough, so strong is the native's belief in witchcraft, that such potions often seem to have the desired effect

vince the natives that this was not a witch who had taken the form of a hyena seeking to enslave another soul.

Some witches have acquired great reputations and are in demand throughout Zululand. It may even be said that the witch becomes immune to punishment in proportion to his reputation. Eminent witches are called by rival chiefs to throw spells over their enemies, and may even be secretly attached to a chief's staff, although they are outlawed by the white man. The chief himself, however, is careful not to be openly associated with witches, or in any way thought of as practicing witchcraft.

PROTECTION FROM BLANK CARTRIDGES

When I was with Selimano Zulu, paramount chief, I entertained him with my usual bag of tricks, including that of the color-changing handkerchief. For the native this meant witchcraft, but I assured the chief it was merely a mechanical trick. On offering it to him as a gift he accepted it but seemed annoyed at not being able to make use of it. He explained that, if he performed the trick before his people, they would suspect him of witchcraft, which was unbecoming a chief, whereas, if he let his people in on the trick, he would lose face for having divulged it. But the average chief will make use of avowed supernatural powers, falling short of witchcraft, to maintain his prestige. I watched a chief demonstrate before his people with a double-barrel shotgun. A native was lined up a few yards distant, and the chief, after placing a charmed necklace around his neck, levelled off and shot point-blank at him. The man walked off, scared out of his wits, but unharmed, and the chief explained that he had protected the fellow from harm, even from the white man's bullets. A sheep was then produced and tied to a stake at about the same distance. When the chief blazed away again the sheep fell dead with a huge wound in its body. The sheep had not been immunized from harm by the chief. The natives, of course, never realized that the shot from the first shell had been removed,

but attributed the miracle to the chief's power of protecting his people.

The influence of witchcraft on the native mind, and the rôle played by the witch-doctor, were vividly demonstrated to me when I was staying with the Changane-Zulu tribe in the low veldt along the Sabi River.

At this time I had a native skinner, by name Ngzimba, who was in the habit of disappearing at night although there were no villages near the camp. I soon learned that he was spending the time at the river bank, waiting for elephants to come down to drink in the hope that he could pick up some elephant dung. In moving camp, he piled a bag on to the truck, and since it smelled bad, I asked for an explanation. He then confessed to the elephant dung. Some weeks later he came into camp with a bundle of giraffe ribs under his arm. As the skinner, he was able to collect other bits, such as lion fat, all of which he piled on the truck. It turned out that this was destined for a witch in return for a love potion.

When we made camp at the Sabi River, Ngzimba disappeared for days. We learned that he was courting a girl in a near-by village, the daughter of my native hunter, Bones. This man had refused to let his daughter marry Ngzimba, since the latter could not produce the *Lobola*, that is, the price of thirteen cows, for the girl. Elopement would have meant theft, with the father taking revenge on Ngzimba's relatives while Ngzimba was fleeing Zululand. The alternative was witchcraft, not in a serious way but sufficient to make the girl infatuated with him. When the opportunity offered itself, he made use of his love potion by rubbing it on the girl's arm and then telling her that she was now in his power and that when the moon rose she would be drawn to his kraal or else be made to dash about braying like a zebra.

I learned of this later, after I had seen the father of the girl consulting a witch disguised as a fortune-teller. In a squatting position, constantly clapping his hands, he kept re-



Zulu Warriors

This active group of armed men is engaged in clearing the air of adverse spirits, in order to make a way for a bridal procession. Such protection against dangerous spirits plays a large part in the life of all Zulus

peating that his daughter was bewitched, while the witch kept mumbling the name of Ngzimba. When the performance was over, I asked Bones what it meant, and he said that his daughter was bewitched, that she was running about braying like a zebra. Going out of the kraal, we saw a group of native women running after a girl along the edge of a precipice. They fortunately caught her in time, and when we reached the point, I saw that the girl was mad. She was dragged back to the kraal, shrieking and actually braying, and I was told that this had been going on for days.

I heard no more of the matter for some days, but the mysterious silence of the natives, including my own men, made me suspect that something was up. Where before they had laughed about the love potion affair as a good joke, they now merely shrugged their shoulders when asked for news. On my next trip to the village, I finally discovered what was going on. The path crossed a ravine, but on this occasion my men tried to make a detour on the pretext that the stream was no longer fordable. Since it was the dry season, it was obvious that the stream had not risen since I last crossed it. I finally got the real reason out of one of the men. A great witch-doctor had come into the country and was about to drive all evil spirits from the people, and he had chosen that very ravine for the spot where he would drown those evil spirits.

It turned out that the witch-doctor was Lucas M'Zunga, a great Voodoo doctor, a combination of witch and witch-doctor with a smattering of the white man's religion. I approached the place with caution in the hope of watching the performance unobserved. The Voodoo practice, as any witchcraft, was forbidden by the white man's law, and my appearance would probably have disrupted things. But I was soon discovered, and so proceeded to assure the doctor that he need have no fear since I was not a government official. After some hesitation, the man came forward and in Zulu, with a few English words thrown in, said that he was

about to drown some spirits. There were three pots near by, with fires beneath, and some of the women were pouring water into them. The Voodoo doctor, dressed in a black robe, stood there holding a Bible in Zulu script, and mumbling incantations. The patients now came forward, stripped to the waist, to be annointed by the Voodoo doctor with lion fat, and among them was the girl who had been bewitched by Ngzimba, muttering to herself but no longer raving. Each of the patients was then told to kneel and drink from the can of water placed before him, while the doctor kept up his incantations. The hot water was served in gallon cans, which formed part of the Voodoo equipment, and the patient was not allowed to stop drinking until the can was emptied as otherwise the magic would lose its force. As soon as one can was emptied by a patient he would be given another, urged on by being told that the more magic he consumed the more certain was the cure. Some were able to finish the second gallon, and all were plainly bloated and apparently in great discomfort.

When all drinking had ceased, the doctor showed them how to insert their fingers in their mouths as far back as possible, with the result that much vomiting started. To those struggling, the doctor shouted that the evil spirit was fighting within them, that it was trying to stay in their stomachs, and must be driven out by throwing it up.

After ridding themselves of the water, the patients got up and walked away with smiling faces, for now they were unwitched. The raving girl was among the cured. When the Voodoo doctor, M'Zunga, left the ravine, his safari contained goats, cows, and sheep that had been paid him for the cure. I later learned from the girl's father that among these were four cows that Ngzimba had owned but which had been seized by the chief's order. Furthermore, Ngzimba had apparently cleared out for good. Had he remained, he would, no doubt, have found his standing in the community very sadly impaired.

Iron

Since primitive man first discovered iron and began to solve the problems its use presented, it has grown in importance until today it forms the basis of one of the world's greatest industries

By

Thomas T. Read

Professor, School of Mines,
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Ewing Galloway

IT is an indubitable fact that the metal, iron, which is outstandingly most useful to man, is found in large mineral deposits of high quality, and these are widely distributed over the world. There are, indeed, but few regions that lack deposits of iron ore capable of being worked for the production of the metal, in at least a small way. In some countries, such as Brazil, there is unfortunately no coal near by, but in all the great iron-making countries of the world there are large deposits of iron ore and coal with which to reduce it to usable metal.

These iron ore deposits have always been available during the whole period, 25,000 years or more, in which men have been making use of minerals to maintain and improve their conditions of existence, but it is only quite recently, say in the last 3500 years, that man has been able to make any effective use of them. It is natural to blame that delay on man, and suggest that it was because he was "dumb" that it took him so long to produce iron from the ore that was available to him in such abundance. That is an unjust inference, however, and it

would be more fair to marvel at the practical skill of the primitive metallurgist who, unable to distinguish between elements and compounds, and with no understanding of the master rôle that carbon plays in the production of iron of usable quality, was yet able, at least as early as 1500 B.C., to produce iron of a quality that was useful to him.

The much debated question as to how early man first produced iron from ore is complicated by the fact that iron occasionally falls on the earth's surface in the form of meteorites, and presumably has been doing so ever since the earth first had a surface. This metal of celestial origin can usually be identified, for it commonly contains from 5 to 25 per cent nickel, whereas the metal man has made from ore practically never contained any nickel until, in recent years, he learned to add it to steel in order to produce increased hardness and toughness. In this way it is known that many races, not only such primitives as the Eskimo but those of a quite advanced culture, such as the Mayas, Incas, and Aztecs



From Mine



Ewing Galloway

"Steaming" freight cars that have been loaded with iron ore in cold weather, at Proctor, Minnesota, to permit the solidified mass to pass through the bottom-dump gates



Ships loaded with iron ore at Duluth, Minnesota, play a dominant part in the waterborne traffic of the Great Lakes. The picture on the right shows one of these ore carriers being unloaded at Buffalo, New York

Ewing Galloway



Courtesy U. S. Steel Corp.

Smelter

The Mesaba Range of Minnesota contains one of the world's greatest deposits of iron ore, a fact that has gone far toward making the United States dominant in the iron industry. The photograph above shows a vast "open pit" mine at Hibbing, Minnesota. At the right, ore from these mines is shown stored at Cleveland, Ohio, prior to smelting



Ewing Galloway

had never learned to produce iron from ore, because the small amount of iron they possessed is indubitably of meteoric origin. But not every museum specimen has been analyzed, and there is also sometimes doubt as to whether ancient iron objects are really as old as the surroundings in which they were found. Consequently the early history of iron is clouded with much uncertainty.

THE NATURAL HISTORY OF IRON

A fairly certain landmark in the history of iron is a clay-tablet letter written about 1300 B.C. "by one of the Hittite kings saying that he was about to send a shipment of 'pure iron' to Rameses II, who had asked for it, and that meantime a sword of iron was being sent to the Egyptian king as a gift." (*Ancient Times*, p. 244.)

In reaching an understanding of what this letter signifies as to the status of iron-making at that time it is necessary to remind ourselves of the basic elements in the natural history of iron. We have already said that iron ores are widely distributed. Deposits that contain millions of tons are not uncommon and are the ones most talked about, but primitive man was not interested in millions of tons of ore. Even as late as the Eighteenth Century here in America a furnace that used more than a few tons of ore a week was a large one. Small deposits that are now of no commercial interest were then ample and supported an important essential industry. Enough wood to make charcoal for fuel, a little ore, and a local market for the metal was then enough.

The ore, then as now, was always iron oxide, much the same thing as the rust to which iron returns if it is left exposed to the oxidizing effects of air and moisture. The making of metal from it consisted of utilizing the charcoal to rob the iron ore of its oxygen, thus turning it back into metal. It sounds quite simple, and it is for a modern who understands what "carbon monoxide-ferrous oxide equilibrium ratio" means, and how to control it. But for a primitive metallurgist, who was guiltless of any

such knowledge, it was extremely difficult.

A really preposterous lie often seems to have everlasting life. Herodotus said that men learned how to make iron because the forest on Mount Ida caught fire and reduced the ore to metal. Down to this day many people who should know better make similar and equally preposterous statements about the probable origin of iron smelting. Iron ore cannot be reduced to metal in any such way, because iron happens to hang on to its oxygen with much greater intensity than do lead, tin, and copper. Nearly everybody nowadays knows that when carbon burns, it forms carbon dioxide, but if there is an excess of carbon and too little oxygen, carbon monoxide will be formed. Burning to carbon dioxide yields twice the heat that monoxide does, so it is not merely because the monoxide is poisonous that the normal aim is to burn to the dioxide. Luckily, all you have to do is provide any fuel with plenty of air, and it will burn to the dioxide, yielding all the heat there is in it.

That natural way of burning is no good for the production of iron, however, for the carbon dioxide plays a sort of ring-around-a-rosy with the iron; the iron takes oxygen from it, going back to oxide, and the dioxide is reduced to the monoxide. No metal results from heating iron ore with fuel unless the operation is so managed that there is such an excess of carbon that carbon monoxide is formed in sufficient amount to prevent the dioxide from oxidizing the iron. If that condition is maintained, the heat required to produce iron metal from ore is not very great, only a dull red. Many people erroneously suppose that forced draft is necessary for the reduction of iron, and therefore say that iron could not have been produced before the bellows was invented. But it is perfectly possible to produce metallic iron in a furnace operated by natural draft; the only thing that is not possible is to melt the metal in such a furnace. The primitive metallurgist never melted his iron; he did not need to, for he early found that he could weld small pieces together to make a large



Ewing Galloway

Steel

A steel mill on the Monongahela River, near Pittsburgh, where one of the world's greatest centers of the steel industry has developed. Here an endless output of steel, in its infinite variety of shapes and sizes, is forever passing its ordeal by fire, in order to fill the ever increasing needs of the world



Ewing Galloway

Old and New

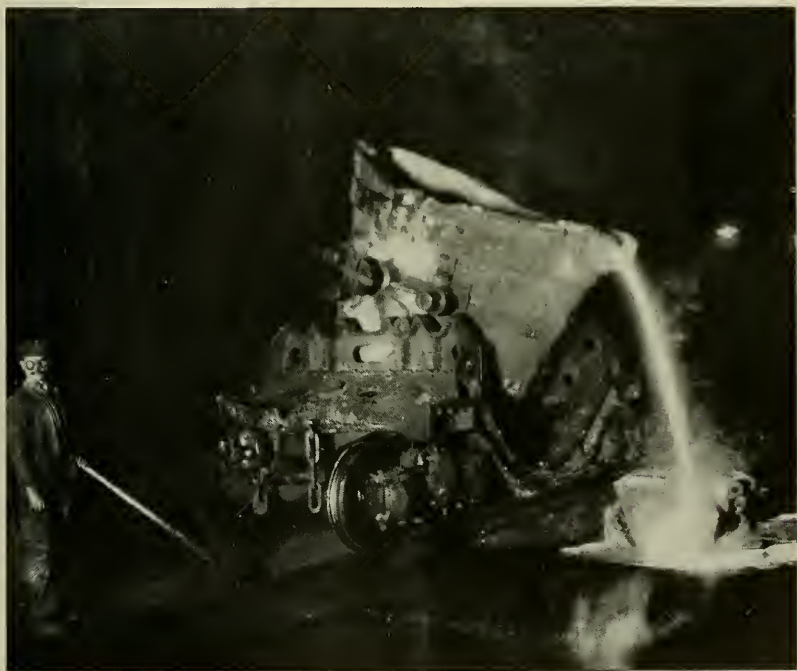
Erected in 1792, this stone structure formed a part of one of Pennsylvania's early steel mills. In the 142 years since its erection, almost the entire development of America as a producer of steel has taken place

Pouring molten
iron from a ladle
into a runner
which conveys it
to moulds



Great ladles on
heavy steel trucks
constantly carry
tons of molten
iron to and fro
about the huge
mills

Ewing Galloway



piece. The lump of metal produced in primitive furnaces was large enough for most of the uses to which iron was early put. It was necessary to work with small pieces, because the metal had scattered through it the non-metallic impurities that had existed in the lump of ore, but, by hammering the lump, most of them could be removed.

CONVERTING IRON INTO STEEL

With enough carbon present so that the iron would not oxidize, a tremendously important thing happens. The iron absorbs carbon, not with the avidity that blotting-paper absorbs ink, but effectively enough to produce marked effects. For if the iron has absorbed as much as 8 or 10 pounds of carbon to a ton of metal and a red-hot piece of it is plunged into water, so it cools quickly, it shows a marked increase in hardness. Metal that is naturally too soft to be of much practical use thus becomes the hard material we know under the generic term of steel. Too much carbon makes it too brittle as well as too hard. One can imagine how difficult it was for the early smiths to secure hardness without brittleness when all they knew was by heating and cooling it in the right way (and if the gods were favorable) they got good metal. It requires much skill to get good results even when you understand what you are doing; it is marvelous that anyone could get good results without understanding the rationale of the process. But all the early swords and armor were made by smiths who were guiltless of any knowledge that there was carbon in iron, or that the solid solution it forms at high temperatures has a transformation point, and that by quick chilling the hard material can be prevented from transforming into the soft metal yielded by slow cooling.

Whether it is correct to maintain that the Hittites were the first people to discover how to make iron that could be hardened, and thus utilized for cutting tools, it is impossible to say. One may raise the question as to whether it could be called a discovery, since

they did not understand it. Also it seems probable that others had previously been able to make some iron of usable quality, for copper smelters and bronze casters surely would have often tried the experiment of endeavoring to produce something useful from the iron ore that was so much more abundant than the raw materials they worked with. However, the Hittite smiths seem to have been the first to acquire a practical mastery of the control of carbon in iron. What they were all trying to do was rather like shooting at a target. The first attempts mostly missed the target, only an occasional one registered by accident. The Hittite smiths were skillful enough so they could hit the target nearly every time, and now and then they scored a bull's-eye in making an object of steel as good as it can possibly be made. Their expenditure of effort was enormous, and the product was correspondingly expensive, but it was well worth it, for a steel sword or knife took and held a much better edge than a bronze one could.

CHINESE SMITHS

In China the smiths learned at about that same time how to make the iron take up enough carbon so it could be melted and cast in the way they had been casting in bronze for generations. Before the time of Christ the Chinese used cast iron coins and made many other things of cast iron, but nowhere else in the world was it used much, apparently because it cost too much in proportion to its usefulness. Up to the Middle Ages the Western World used relatively little iron, nearly all of it of the composition we call steel, and employed it for spears, swords, knives, armor, and to a lesser degree for peaceful purposes.

So far usable iron had been made by producing carbon-free metal and causing it to absorb enough carbon so it could be hardened. As furnaces used for the purpose grew larger, temperatures were increased, and the time of the exposure of iron to carbon grew longer, some fused metal was



Ewing Galloway

With Skeletons of Steel

Without its intricate and weight-bearing skeleton of steel, the modern skyscraper would never have developed, for masonry walls thick enough to bear the weight of such structures would seriously cut down the available space within

occasionally made, because if iron takes up as much as about 80 pounds of carbon to the ton of metal it melts at a temperature of 1180°C. Metal that is high in carbon is so brittle that it cannot be used for anything but castings, but in steps that cannot now be traced it was, by the Middle Ages, found possible to strip it of some of its carbon and bring it down to a usable content. Finally, in 1784, Cort learned how to produce carbon-free iron from the high-carbon fused metal, and the wrought-iron industry was born. The product made in this way was somewhat different in quality from the small lumps of carbon-free iron made by primitive metallurgists, but the main significance of this development was that it produced carbon-free iron in larger quantities at a lower cost. Wrought iron became abundant and fairly cheap, because mechanical devices for rolling it into bars and strips had simultaneously been invented. This was a landmark in iron's history.

ALLOY STEELS

The next great landmark in the story of iron was Bessemer's discovery that, if air was blown through melted iron containing about 80 pounds of carbon per ton, the carbon could be quickly and cheaply burned off. Steel was thus, for the first time, made in large quantities at a low cost. Later it was found that a slower operation in the open-hearth furnace produced steel of more uniform quality, and the tendency in steel manufacture for the last fifty years has been toward metal of higher and more uniform quality.

This late period has seen the rise of the alloy steels. Careful study of the nature and constitution of steel revealed the effects produced by adding nickel, chromium, manganese, vanadium, molybdenum, and other elements to it. Nickel, for example, makes the steel hard without making it brittle; nickel and chromium together produce a better effect than either used alone. Everyone is now familiar with "stainless" steel, and many realize that it contains 18 per cent chromium and 8 per

cent nickel. Properly made and treated, it resists corrosion to an unbelievable degree. Steels can be made to resist specific corrosive agents, and with various physical qualities, such as unusually high permeability for lines of magnetic force, or with low permeability if that is desired. It can be made resistant to corrosion at high heats, resistant to abrasive wear, resistant to shock, or having almost any combination of qualities desired. Just as a cocktail costs more than a glass of beer, these special steels cost much more than common steel; some of them thirty or forty times as much per pound as the "mild steel" so familiar to everyone in the construction of modern office buildings.

It should not be forgotten that just as the essential material in the bewildering variety of cakes and pies to be had in a bake-shop is flour, so the essential constituent in all these steels is iron. Starting with iron ore, coal, and limestone, often transported hundreds of miles to a furnace that can produce a million pounds of a fused iron in a day, steel is made from it and rolled out in usable forms that sell for only a little more than a cent per pound. Most agricultural commodities that are produced mostly by the forces of nature cost several times as much, and our modern iron industry is an outstanding example of how production costs can be lowered by large-scale production.

ADVANCES DURING THE LAST CENTURY

The amazing developments, especially in the past century, in iron production are not simply, or even chiefly, the result of large-scale methods. They are basically the result of painstaking and careful study of the nature and constitution of iron and its alloys, beginning with the iron-carbon alloys and now embracing everything that may be alloyed with iron. From a practical mastery of the effects of carbon on iron, metallurgists have progressed to where they are now able to produce iron of almost any quality, or combination of qualities, that may be desired to give the best results in serving any human purpose.

A Trailside Tenderfoot

The adventures of a cigar-maker amid an unfamiliar world at the Trailside Museum and Nature Trails, on the Hudson River

Photographs by Laurence Critchell, Jr.
(except as noted)

by William H. Carr

Assistant Curator
Department of Education, and
Director, Trailside Museums,
Bear Mountain, N. Y.

WITH deft fingers Hermon had personally manufactured thousands of cigars for a period of twenty-six years before machinery and the depression combined to force him to accept a position with the "C.W.A." He came to us at the Trailside Museums in the capacity of "general helper" during the summer of 1933. We liked him at once, and our first impression has not changed. Although his Russian was far superior to his English, we were soon able to exchange ideas without undue difficulty.

Hermon is a true student of people. His interest in birds and animals, however, has been largely acquired. We will let the reader judge by the following incident whether Hermon could really "see what he was looking at."

When President Roosevelt crossed the near-by Bear Mountain Bridge, our "general helper" momentarily forgot his work in the raccoon cage and, hat in hand, shuffled over to the bridge toll house to see the procession. From an excellent vantage point he gazed earnestly into the Chief Executive's face. When the resplendent automobiles in the President's party had passed, after having paid toll, Hermon turned to his nearest companion and, with great seriousness, remarked,

"It looked just like him!"

After having made this observation, Hermon, slightly mystified at the resulting laugh, returned placidly to his duties.

We had delegated the task of animal care to him because of his gentleness and conscientiousness. At first he had been rather timid about entering the various cages. He

preferred to be on the outside, looking in. After repeated assurances and reassurances, however, he ventured over the thresholds and behind the wire.

Hermon's early experiences in the various cages were pure adventures. Each bird and animal was an absolute stranger to him, a stranger to be cultivated with respect and caution. Our tame turkey vulture annoyed him most of all. He did not object to the owls, hawks, raccoons, deer, crows, or other creatures, but the vulture was "different."

"He likes me not!" Hermon complained.

Hermon had been present when the young vulture arrived, hissing and protesting, in a pasteboard box, direct from its rockledge home on Long Mountain.

He shifted excitedly from one foot to the other as the box was untied and the downy bird burst forth.

"It's a eagle?" he asked.

We explained that it was not an eagle.

"I not like eagle," Hermon announced, though he would give no reason for his aversion. Nor did he grow to like the vulture.

"Willie," the staring, yellow-eyed, great horned owl in the next cage, had a far more alarming aspect than the vulture. Regardless of this, Hermon showed no qualms whatsoever upon entering this enclosure. He would go about his cleaning and frequently would talk to the unresponsive bird, perched statue-like upon its perch.

"Aren't his eyes beautiful?" we would ask.

"Yeah!" said Hermon.

He admitted that he had been alarmed about the owl at first.



At Bear Mountain

Fifty-seven acres of the Bear Mountain Harriman Section of the Palisades Interstate Park have been set aside for the American Museum's Nature Trails. Eight buildings have been erected to house the exhibits and the staff, and at this point on the Hudson River, forty-five miles north of New York City, the country's leading Trailside Museums have been developed. The above photograph shows the Trailside Geological Museum, while the picture below was taken in front of the Trailside Botanical Museum



Visitors examining the moss and lichen gardens installed near the Trailside Botanical Museum



The photograph below shows the main automobile entrance to the Trailside area as it appears from the top of the western tower of the great Bear Mountain suspension bridge



Photograph by Le Roy Davis

"I not know," he said, "I think he might be dangerous, but I see now, no!"

By way of explaining his dislike for the vulture, he would remark, "The people not like him, too!"

In this Hermon was correct. The vulture's naked head, moist beak, and small eyes, combined with its stoop-shouldered, lurching walk, inspired anything but admiration. The fine plumage and remarkable development of the feet, head, and wings seemed to attract little attention.

THE VULTURE'S "CHILD"

We often pointed out the large, adult, wild vultures soaring masterfully overhead. Hermon found it difficult to believe that these graceful birds, seen high above, could bear any relationship whatsoever to his particular charge. Despite Hermon's antipathy toward the vulture, he nevertheless was much amused when, one day, a visitor, on observing the larger bird's cagemate, a sparrow hawk, offered the opinion that the hawk was the vulture's child!

"No, no," laughed Hermon, "He's different kind altogether!"

One characteristic of Hermon's annoyed us at times, and that was his extreme reticence. He seldom spoke unless spoken to, rarely expressed an opinion, and sometimes kept to himself information that would have been highly useful to us. A good illustration of this latter trait concerned the case of the opossum and the mice.

A miniature "apartment house" had been built to house some white-footed mice and a young opossum. The smaller animals occupied the top floor. While its own cage was being cleaned, the opossum was usually placed for a moment in the mouse compartment.

One winter day the process was repeated just at noon time and the cleaner decided to complete the task after lunch. Consequently the opossum was left to its own devices in its neighbors' house for some forty minutes. Hermon sat in full view of the cage while drinking his coffee and munching his sandwiches.

On returning from lunch the cleaner finished his work and returned the opossum to its ground floor quarters. He placed a full ration of food in the mouse house and closed the door. On the following morning the mouse food remained untouched. Before investigating further as to the cause of this strange behavior on the part of the mice, we interrogated Hermon.

"What's happened to the mice, Hermon?"

The answer was very direct and enlightening.

"The 'possum he eat 'em!"

"What! You sat there yesterday and watched the 'possum eat the mice! Didn't you do anything to stop it? Why didn't you tell us, anyway!"

Hermon shrugged his shoulders.

"Well," he said, "You give mice to snakes!"

That evening the live traps were placed in the woods, baited for mice, and thereafter the opossum rested in an egg crate whenever its residence was being cleaned.

Hermon walked the length of our Nature Trails each day, to and from work. He had no other choice than to pass many labels upon the trees and flowers along the way. He often stopped to read the signs, though we never had any proof that the information became implanted in his mind. In fact, about the only botanical reference he ever made had to do with an experience of his in the World War.

It seems that he had been marching along a road near the front line trenches when, suddenly, the enemy burst out with a murderous machine gun fire that killed 118 of his companions.

"They were behind trees hidden!" related Hermon, "Always I look at trees after that!"

This was a sad background for nature trail appreciation.

As months went by, Hermon "grew" upon us. We realized that he was in a different world on the Bear Mountain Nature Trails. Sitting in a dusty room, fashioning tobacco leaves, had not prepared him for a life in the open. He still carried an umbrella

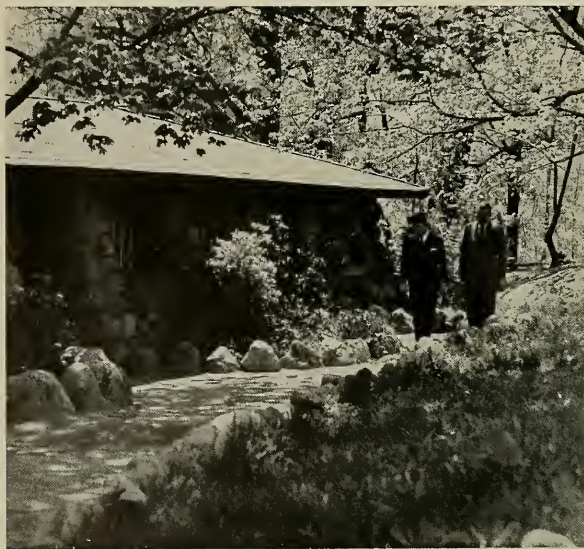
Creatures of the Trail

The inhabitants of the Trailside Zoo are entirely natural to the vicinity, and many visitors are surprised at the wide range of local fauna



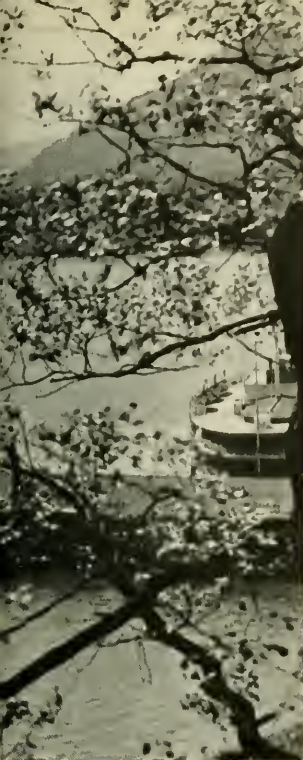
The Trailside's barred owl was photographed by means of light reflected from a mirror. The baby cottontail rabbit was always an easy subject for the visiting photographer, while the spring peeper shown on the rhododendron leaf at the left was far less obvious to the eye than to the ear





Trailside Views

Situated directly across the Hudson River from the mountain known as "Anthony's Nose," the Nature Trails lie at one of the narrowest places in the Hudson between New York and Albany. The picture above, taken from Geology Point, shows Peekskill faintly in the distance. The photograph at the left is of the Trailside Craftshop



The snake pit which lies just beyond the wooden rail shown in the picture below probably attracts more attention than any other one exhibit

Throughout the Nature Trails, trees, flowers, and rocks are carefully labeled for the information of the visitor



through the woods whenever it rained. He was the only C.W.A. man to do this.

When snow and ice covered the ground, he was extremely cautious. When walking upon an icy, slippery surface, he would grasp any object whatsoever to support himself, feeling his way along as though he were blind, while his companions strode on ahead. On one occasion, when passing the staff cabin in mid-winter, he grasped a long, slender, hanging icicle, for support. When it snapped off in his hand and he sat down unceremoniously in the snow, an expression of surprise and wonder crossed his face, as though an iron bar had given way.

THE FRIENDLY RACCOONS

For a time Hermon lived in fear lest the raccoons escape when he opened the door of their cage. At first he would ask someone of us to accompany him to the cage door to prevent any obstreperous action on the coons' part. Once safely inside the cage, he would carefully clean the watering trough and sweep the floor. When the raccoons approached him, he would talk to them softly, and smile.

Occasionally the friendly and playful coons would grasp Hermon's leg. This made him nervous at first, but eventually he became accustomed to the procedure and would glance at visitors with a pleased expression as though to say,

"See! they like me and I'm not afraid!"

Sometimes the acquisitive animals would search in their keeper's clothing for food. A long, slender, clever forepaw would suddenly reach into Hermon's coat pocket, much to his alarm. This last familiarity was always rather startling to him and he would invariably retire, slowly but firmly, until the offending coon became discouraged and desisted.

In the course of various journeys about the Trailside grounds, Hermon would approach the out-of-door, circular pit, where many large, local snakes were exhibited. These creatures fascinated him. He would stare at them for many minutes until the rake in

his hand reminded him that there were gravel paths to be cared for.

During the spring, we kept in a single cage, a Virginia deer fawn, a partridge, and a cottontail rabbit. Often we would discover the partridge sound asleep between the reclining deer's outstretched legs, with the rabbit snoozing near by. This companionship among the animals pleased Hermon. When the three creatures were sleeping together, he would enter the cage very cautiously and go about his duties as quietly as possible lest they be disturbed.

Invariably, a movement of his broom would awaken first the partridge, then the deer, and lastly the rabbit. The partridge, with a preliminary flourish of feathers, would bustle off beneath the shelter platform. The cottontail would scamper away, and the deer would come to its feet and regard Hermon inquiringly.

Although this process was repeated day after day for many weeks, Hermon still persisted in his kind attempts to step softly until the animals had actually moved, then he would proceed, more energetically, to complete his work.

On one occasion Hermon entered the deer pen as usual. The rabbit at once bounded away, the deer arose from its nap, but the partridge did not stir. Hermon regarded the phenomenon with startled eyes. He propped the broom in one corner of the cage and anxiously approached the bird. Still it did not move. Finally Hermon stood directly beside it. Then he knew that the partridge would never bustle off again. Hermon came to us at once with the information. We explained that the bird had been brought to us earlier in the year, wounded with shot, and that its wing had been broken. We expressed sorrow that, after all these weeks of care, the bird had finally succumbed.

Hermon listened attentively and then shrugged his shoulders and said sadly that "the first shall always be last." We asked him what he meant by this sage remark.

"Well," said he, "the partridge, he always get up first, now he's last for good!"

The pilot black snake at the right was photographed in the Trailside snake pit in which, with his sinuous cousins, he lived during the season of 1934

Snakes and Frogs

Hessian Lake, which adjoins the Trailside area on the west, is the source of more than a few of the museum's lively exhibits. The bullfrog below, and others of his kind are natives of this body of water



Hermon was truly something of a philosopher. He did not quote very often, but when he did, it was usually worth listening to! Rarely he invented phrases of his own.

Once, when looking for Hermon, we stepped from the workshop door and called to him loudly. To our surprise he appeared from behind a small tree near by. He was almost within whispering distance, yet we had not seen him, so well had he been concealed by the foliage.

He walked up with a smile, looked back at the tree, and said,

"Few leaves hide man!"

This seemed so much like a quotation from "Charlie Chan," or from his prototype, a Chinese Philosopher, that we asked Hermon where he had read the saying.

"No read," said he, "but true, no?"

We agreed that it was perfectly true.

These rare and revealing lapses of Hermon's would always serve to encourage us to question him in regard to his opinions about things in general, and his present employment in particular. Seldom were we successful in eliciting any satisfactory response. He once admitted that he was still thoroughly at sea in regard to any applied natural history knowledge. He confided that, though he was definitely interested, birds and animals were still just animals and birds to him.

"Fish, now maybe, that's some different!"

He said that he had frequently gone to the Hudson River, and to the ocean beaches on fishing excursions, and that he liked to name and to know the fish that accepted his bait.

Perhaps it was his "fish interest" that accounted for the extra polish he gave to the glass of our aquariums when they were transferred from the Trailside Museum to the Crafthouse winter quarters.

While Hermon could not express himself clearly in English, whether the subject happened to be fish, bird, or beast, it was our own limitation rather than his, that prevented our being able to converse clearly together. He could speak German and Hebrew, in addition to Russian. We are certain that our Russian dialect would have

been far more amusing to him, than his English accent was to us. And, while we are discussing comparisons, it might be well to say that we would have difficulty in rolling cigarettes, to say nothing of the appalling prospect of making cigars for a space of twenty-six years! Considering Hermon's background, we are certain that his ability to adapt himself to a totally new vocation would be far superior to ours if conditions were reversed.

The calls of birds were very pleasing to Hermon. As though to chide us for any real or supposed thought that our knowledge of the out-of-doors was superior to his, he once shyly told us, though in different phrasing, that an appreciation of the beauty of bird song was by no means dependent upon language nor upon ornithological understanding.

Hermon was a lover of music in no uncertain terms. We learned that he possessed a complete collection of the Italian, German, and American phonographic recordings of Caruso. He also owned many recordings of famous symphonic and concert orchestras. The only one of our "staff" who could discuss music with him, on his own level, was an Italian cabinet maker, also a "C.W.A." employee. This despite the fact that several members of our group were by no means unaccomplished in musical performance.

"I like good music," Hermon said, "but jazz, No!"

In "better days" he was a frequenter of the Metropolitan Opera House and of Carnegie Hall.

"Some day, again, maybe I shall go," he would say.

Thus Hermon was marking time, as so many of his compatriots were doing throughout the land. With him, this was but an interlude among the birds, animals, and plants. When, and if, the better days come to him, he will return, perhaps to his cigars, and perhaps not. Whatever may occur, there is one thing of which we are perfectly certain, we shall miss Hermon more than he will know!

Nebraska—Fifteen Million Years Ago

Ages ago the grassy plains of what is now Nebraska were inhabited by animals long since extinct. In the following article they are brought to life as a result of scientific study and a scientist's imagination

by

Edwin H. Colbert

Assistant Curator, Fossil Vertebrates
American Museum

Illustrations by Margaret M. Colbert

IT was a hot day out on the high plains, and the sun like a ball of fire that seemed to fill the cloudless sky, made the whole world brilliant and white under its blinding glare. Waves of heated air, rushing up from the dry prairie, caused the distant buttes to shimmer in the midsummer noon. A palaeontologist, tired and cramped from his morning of hard digging in the fossil quarry, climbed up out of the excavation to the top of the hill, where perchance he might enjoy any breezes that would be blowing across the western plains.

He reached the summit of the butte and, seating himself at the edge of the steep quarry face, looked down on the place where he had been working. At his feet there was an extensive platform—the quarry floor—on one corner of which, like a postage stamp on a letter, there was a square of freshly exposed rock. Here was his excavation, following a rich stratum of fossil bones back into the hill.

Shielding his eyes against the dazzling brightness of the sun, he peered out across the broiling plains. In a shallow valley near by flowed the Niobrara River, occasionally bordered by scattered cottonwoods that traced green serpentine lines through the yellow grass. Beyond were innumerable low buttes and escarpments that glittered in the hot light and stretched away, mile after mile, to meet the edge of the blue sky.

He looked down at the river, flowing serenely toward the Missouri, just as it had been flowing for countless years in the past. "How insignificant that stream would seem

to be in the general scheme of things" he thought to himself, "and yet it is the only timeless thing in the land. Mountains rise, and are worn away by the action of rivers and streams, plains are cut into badlands, and in turn the badlands are leveled into new plains, life evolves and changes, yet the work of water goes on without ceasing. What stories that stream and the streams that flowed before it might tell of the world as it used to be—what they might have seen of the life that now lies buried at my feet, if only one could follow them back and back in time, back to the Miocene, millions of years ago, when those bones down in that hillside were alive!"

* * * * *

The grass was lush and green, and the sun shone bright and warm, for it was springtime and Nature seemed to be in a placid mood. Across the green plains there roamed a herd of miniature camels, delicate little animals no larger than gazelles. To say that they were camels may create a false impression, because they were more like modern llamas than like camels as we know them. These small, prehistoric camels were graceful of form, with long, slender necks and legs, and slender bodies. The herd moved slowly across the prairie, because the animals were feeding, nibbling off the leaves from low bushes, and cropping especially succulent clumps of grass.

Suddenly, from behind a grassy hummock, two large dogs rushed out on the herd,



howling as they ran and slaving at the mouth. They were out to kill, and they rushed on like a devastating wind, hoping to run down the herd of gazelle-like camels by the sudden speed of their attack. Their yellow eyes glittered, their white fangs gleamed, the bristles of their rough coats were raised, and their long, heavy tails streamed out behind them as they ran.

The tiny camels leaped away in fright, and like a flash they were off, streaking ahead of the great dogs. For a moment it looked as if the hunt would be of short duration and futile, because the camels were fleet of foot, and the dogs, for all their precipitate haste, were clumsy runners. But just as the camels were getting safely ahead of their pursuers, one of them squealed and hurtled forward, rolling over and over in the dust. He had stepped into a rodent burrow.

In an instant the dogs were on him and the hunt was over. The great "bear dog" of the Miocene, *Daphaenodon*, had secured his food. *Stenomylus*, the little camel, was the victim.

Far across the plain a large *Moropus* lumbered clumsily toward the river. In general appearance this animal looked something like a large horse, at least as much like a horse as like any other animal that may be called to mind. He had a long head with a rather horse-like face, but there the comparison ends. His body was heavy and was supported by long, thick legs. Moreover, his front legs were longer than his hind legs, thereby causing his back to slope down somewhat from the shoulders to the tail. Yet, as if a heavy, barrel-shaped body held up by long fore limbs and short hind limbs weren't incongruous enough, this animal had, of all things, claws on his feet instead of the usual and expected hoofs. Surely here was a creation of nature that would have been dear to the hearts of the mediæval unnatural historians, those worthy scholars who, in the brave days of the crusades, designed unhappy griffons for the heraldic shields of bold knights. *Moropus* was a strange mixture indeed, a grazing animal



Bear Dogs and Camels

A Miocene chase in northwestern Nebraska, some fifteen million years ago. *Daphaenodon*, the great "bear dog" is pursuing *Stenomytilus*, the small gazelle-like camel

related to our modern horses and rhinoceroses, but with clawed feet of peculiar and aberrant structure.

Moropus went along sniffing the ground. Suddenly he stopped and began to dig in a most efficient way with his great, clawed feet. The dirt flew out in a fusillade of black clods and gritty stones, making a great clatter in the grass. A little rodent, disturbed in his midday meditations within a near-by burrow, came forth like a beadle out of a library, and began a furious chatter, swearing at his disturber with the richest and most violent epithets in his vigorous, if limited vocabulary.

Moropus paid little heed to the heckler in front of him, but kept scratching away until a large, white tuber was exposed to

view. This he pulled up with his heavy claw. Then putting his head down, *Moropus* grasped the tuber between his teeth and began to chew it with an air of great satisfaction, all the while looking around as if to determine a spot to prosecute further excavations for dainty morsels. And all the while *Steneofiber*, the little rodent, chattered on in a loud and strident voice.

Moropus wandered on, and *Steneofiber*, assured that he had achieved a tactical victory, started to retreat to the haven of his burrow. But he was not to retire in silence to his subterranean seclusion. Another visitor had come to disturb the peace of his life.

This newcomer would seem to be a small, antelope-like creature, about comparable in size to a very small deer. As a matter of fact it was more nearly related to the giraffes, but even at that the relationship was not close. The peculiar thing about *Syndyoceras*, for such was this animal's name, was the fact that he had four horns on his head. There

was a back pair above the eyes, in the usual place for horns, but then there was a front pair on the nose of this beast. Which of course made *Syndyoceras* a peculiar looking animal—if not to another *Syndyoceras*, at least to us and to our way of thinking.

Syndyoceras nibbled at a few tufts of grass and then moved on toward the stream that had lured *Moropus* before him. He departed over the plain, keeping his eyes and ears alert for potential enemies, followed by a blistering string of oaths from *Steneofiber*.

There was a sound of loud cracking and the breaking of branches in a small clump of

willow trees near the stream. Grunts and squeals of philharmonic magnitude smote the air, as several giant, long-legged, piglike animals, with vociferous manifestations, scratched their backs and rubbed their sides against the rough tree trunks. To say that these animals were pigs would hardly be a correct description of them, but they were more nearly related to our modern pigs than to any other animals that are familiar to us. They were as large as bison, standing five or six feet in height at the shoulder, and their legs were long, well adapted to rapid running. They had



Four Horns

Syndyoceras, the four-horned ruminant of Miocene times. This animal somewhat resembled the antelopes of today, but was in reality more nearly related to the giraffe



Dinner and Oratory

Moropus digs up roots while *Stenocyon* sits at the edge of his burrow and makes a few choice remarks. *Moropus* was a grazing animal, very distantly related to the horse of today but, oddly enough, was equipped with a large set of claws which he undoubtedly used for digging up tubers and roots

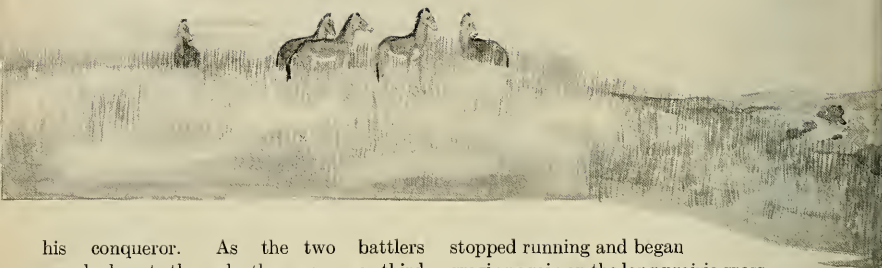
tremendous heads, and they were armed with cruel tusks that flashed white in the sun as they rooted in the ground or snapped peevishly at one another.

Dinohyus, the "terrible pig" and ruler of the Miocene prairie, was most certainly enjoying himself in a piggy fashion, through the yellow sunlight of a golden afternoon. His small, mean eyes flashed the evil temper that was inherent within him.

Two large *Dinohyus* boars had evidently been at outs with each other for some time. Neither would tolerate the other within biting distance, and an even moderately close approach of the two to each other was signalized by much growling and showing of teeth. One of these boars, in rooting around under the trees, uncovered a large snake, which he promptly killed. Then he

began to devour it with noisy satisfaction, and that was too much for the self control of his antagonistic companion. This second boar decided that he would "muscle in" on the feast, and right there he made a big mistake. With a roar the first boar charged, tusks bared, eyes glittering, and bristles up. Instead of turning to run, the second boar threw himself at his enemy. The fight was on.

There was a blur of gigantic forms as the two adversaries met. Tusks and hoofs flashed in the sunlight, and the dust arose in clouds, partly obscuring the combatants. Truly it was a battle of titans. The row didn't last long, for the second boar, soon convinced that he had had enough of it, turned and dashed at full speed for the open plains beyond the trees, followed closely by



his conqueror. As the two battlers smashed out through the grove, a third *Dinohyus*, one of the reputedly gentler sex, calmly walked over to the field of combat and proceeded to encompass the dead snake.

The noise of the boars fighting caused a herd of three-toed horses, small animals no larger than sheep, to stop grazing and to peer inquiringly at the clump of trees. As they watched with equine wonder, the two boars charged out on to the plain, heading directly for them. With shrill whinnies of alarm the horses wheeled and sped off ahead of the *Dinohyus* boars, and here was the strange spectacle of horses no bigger than sheep fleeing ahead of boars as large as bison.

The flight, like the fight, ended abruptly. The pursuer suddenly stopped short, turned and ran back to his unfinished dinner, which by this time was resting inside of pig number three, while the pursued, seeing that he was no longer the object of dinohyine wrath, swung about and followed his antagonist back into the grove.

Meanwhile, the herd of *Kalobatippus*, the little three-toed horses, having realized that their fright was without foundation, had

stopped running and began grazing again on the long prairie grass.

A water bird, wading in the shallows of the stream, gave a raucous call of indignation and flapped heavily to a sand bar down the river. It had been disturbed by a large animal swimming toward its feeding ground. This animal majestically steamed into port, and with more haste than ceremony clambered out on to the sand bar. The newcomer was as big as a large hog, and in proportions was not unlike a small hippopotamus. Its body was long and heavy, and its legs were short. The head was very broad at the cheek bones, and there was a rather narrow muzzle. *Promerycochoerus*, an animal distantly related to the modern pigs and looking like nothing imaginable, waded through the shallow water over the sand bar and climbed the near-by bank to join his mate, feeding in the grass among the trees that bordered the shore. Several small offspring of this domestic couple rooted around in the grass by their mother, running forward now and then to partake of some titbit discovered by the parent.

A quick movement in the tall grass near the river bank caused the family of *Promery-*

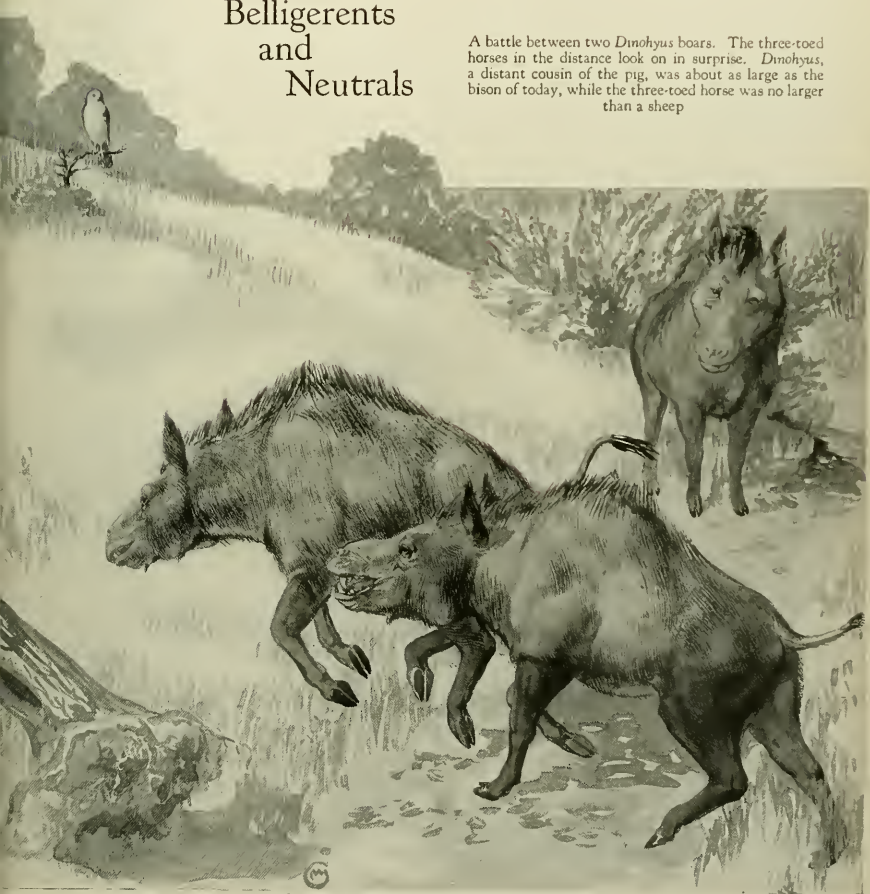
cochoerus to stop in its quest for food and to look toward the source of the disturbance. Nothing was to be seen, nor were any smells of danger brought to the several wet noses, pointed knowingly into the light afternoon breeze, so the dinner was continued.

A sharp-eyed observer on the opposite bank of the stream, looking toward the water's edge, might have seen a drama of great interest on a small scale. A weasel-

like animal about as large as a badger, but with a short face, a heavy body, and robust legs, was crouched, intently watching a tiny shrew feeding near the water. The shrew scurried back and forth, rapidly darting in among the overhanging roots and out into the open patches of sunlight, like an enclosed molecule zigzagging erratically through its own little circumscribed world. Hither and yon it flashed, stopping for a

Belligerents and Neutrals

A battle between two *Dinohyus* boars. The three-toed horses in the distance look on in surprise. *Dinohyus*, a distant cousin of the pig, was about as large as the bison of today, while the three-toed horse was no larger than a sheep



THE GEOLOGIC AGE AND THE POSITION OF THE
MIOCENE PERIOD

	Recent	Civilized man
QUATERNARY	Pleistocene	Stone age man
	Pliocene	Modernized mammals
	<i>Miocene</i> (15 million years ago)	Development of modernized mammals
TERTIARY	Oligocene	Beginning of modernized mammals
	Eocene	Ancient mammals
	Paleocene (60 million years ago)	Archaic mammals

brief instant now and then to devour an unwary, and therefore a dead insect.

The crouching carnivore, quite ignorant of the fact that some day he would masquerade under the name of *Paroligobunis*, watched the shrew with eager intensity. Several times he tensed for a spring, but always the shrew darted out of range before the larger animal could make up his mind to jump. Finally, the shrew, unaware that death lurked near by, stopped for a moment in a sun-flecked glade. The carnivore made a leap through the tall grass, but quick as he was, the shrew was quicker, and hungry jaws made a futile snap as the intended victim disappeared in the protection of a mass of tangled roots.

Much snorting and stamping announced the fact that a herd of rhinoceroses was approaching the river. These were small rhinoceroses, no larger than Shetland ponies, and they were light of body and limb, evidently speedy runners in any kind of a race. They were rather unusual, too, in that they had two horns side by side on the nose, a departure from the usual rhinocerine plan, whereby the horns are arranged in tandem fashion, one behind the other. *Diceratherium*, the two-horned rhinoceros of the Miocene, was coming *en masse* to drink and to wallow in the mud along the river.

The herd was a large one, consisting of a hundred or more individuals, and it stretched

in a scattered file out on to the grassy reaches of the plain. Just as the bison in later days were destined to roam over this same region in great black herds, so these small, active, paired-horned rhinoceroses wandered across the Miocene prairie. They were perhaps the most common and the most characteristic of the larger mammals of that time.

The herd came on to the river, by twos and threes and in small groups, stopping frequently to graze or browse on the prairie grass and the low bushes, wallowing in the dust, fighting and bellowing. As the tail end of the herd approached the grove that lined the stream, another animal herd emerged from the shelter of some low trees at the edge of the prairie. This was a "sunder" of peccaries, small, mean-tempered, piglike animals, fleet of foot and sharp of tusk. Evidently something had startled them, for they came out on the prairie at a run, squealing and grunting. The rhinoceroses knew from experience the temper and the mettle of *Desmathyus*, so they stopped and with considerable respect watched the peccaries dash across in front of them. Then, having let the porcine whirlwind pass, the rhinoceroses continued toward the river, to join their mates, already splashing about in the cool waters.

A golden red sun ball dropped to the western horizon; a Miocene afternoon in western Nebraska was drawing to a close.

"Perhaps," the palaeontologist thought to himself, "the herd of *Diceratherium* became mired in the quicksands of the river. Who knows, perhaps tragedy was the sequel to that calm afternoon so many millions of years ago. How may we account for the rich deposit of bones in this hill—the remains of hundreds, or more likely of thousands of individuals?"

He looked at the white buttes in the distance. The sun had passed its zenith and was now beginning its long journey to the west. The land was empty, and except for a hawk wheeling in the brilliant blue sky, not a living thing was to be seen.

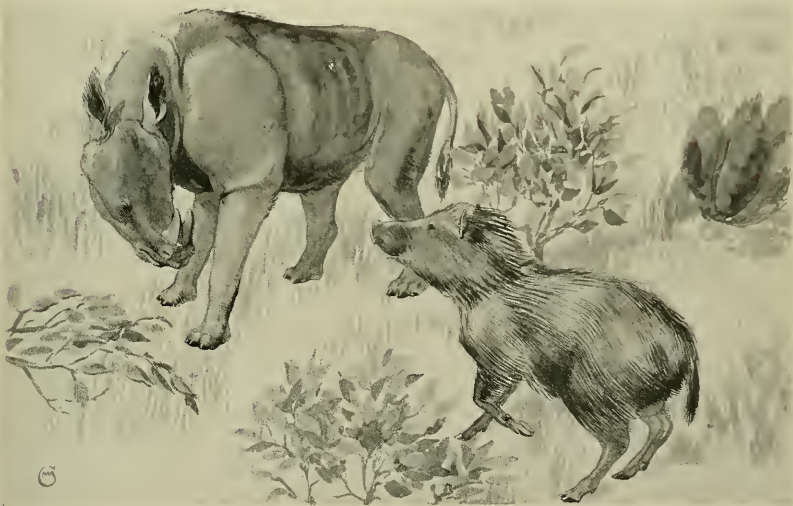
HOW SCIENTIFIC NAMES ARE DERIVED

People often ask why fossils have such "jaw-breaking" names. It seems to the average lay reader that the scientist is being a bit pedantic when he insists on using un-

familiar names for fossil animals. The explanation is that these animals have no other names than their scientific ones; consequently these scientific terms must be used in speaking of the animals. Since these scientific names are derived mainly from Greek and Latin stems, they appear difficult to the average reader. Most fossil animals have scientific names applied to them, but they lack popular names, because the application of popular names to these extinct animals would require the invention of innumerable new and confusing words in every language.

Below is given a list of the animals described in the foregoing sketch, and the meanings of their names. A knowledge of the derivation of the name helps in remembering it.

Daphaenodon (Greek). *daphaenos*—predaceous; *odon*, *odontis*—tooth; *predaceous*



An Unexpected Meeting

Desmathyus, the Miocene peccary, encounters his neighbor, *Diceratherium*, the small, swift, two-horned rhinoceros

tooth. Referring to the sharp, carnivorous teeth of this animal.

Desmathyus (Greek). *desmatos*—a bond or tie; *hyos*—a pig: related to the pigs. In allusion to the zoological position of this animal.

Diceratherium (Greek). *di*—double or two; *ceros*—horn; *therion*—wild beast: the two-horned wild beast. Descriptive of the paired horns on the nose.

Dinohyus (Greek). *dinos*—terrible; *hyos*—pig: terrible pig. A name descriptive of the great size and the supposed ferocity of this animal.

Kalobatippus (Greek). *kalobates*—stilt walking; *hippus*—horse: horse walking on stilts. In allusion to the elongated feet.

Moropus (Greek). *moros*—sluggish or clumsy; *podos*—foot: sluggish foot or clumsy foot. A term distinguishing this animal from the normal hoofed animals, in

which the foot is adapted to swift running.

Paroligobunis (Greek). *para*—beside or near; *oligos*—few or little; *bunos*—mound: A name descriptive of the teeth of this animal.

Promerycochoerus (Greek). *pro*—before; *merycos*—ruminating animal; *choeros*—hog: antecedent to the ruminating hog. A name applied because this animal is ancestral to *Merycochoerus*, the "ruminating hog."

Steneofiber (Greek and Latin). *stenos*—little; *fiber*—a beaver; little beaver. A term expressive of the size and the zoological relationships of this animal.

Stenomylus (Greek). *stenos*—little or narrow; *myle*—a mill (grinding tooth): narrow grinding teeth.

Syndyoceras (Greek). *syndyos*—two together; *ceros*—horn: joined horns. In allusion to the front pair of horns, joined at their bases.



A Miocene Family

A mother *Promerycochoerus* and her young. These water-loving animals often came down on the plains to graze. The adults were about the size of a large hog

Keeping Time

by
Frederick Hellweg,

Captain, U.S.N.,
Superintendent, U. S. Naval Observatory,
Washington, D. C.

The intricate studies and equipment upon which the accuracy of our timepieces is based

To most individuals time and its measurement seem simple enough. One winds one's watch, sets it occasionally, and the matter is cared for. But the accurate determination of time is, for all that, a very complex matter, in which only certain scientific laboratories are competent to act. In reality the matter is largely in the hands of governments—in Great Britain at the Greenwich Observatory, a governmental institution, and in the United States at the United States Naval Observatory in Washington. These two outstanding observatories not only determine time accurately, but also have equipped themselves to broadcast, a number of times each day, radio signals that make it possible for anyone in the world to check with absolute accuracy the timepiece at his disposal, merely by tuning in his radio receiving set on the proper wave length. Thus sea captains need no longer depend for days or weeks on the supposed accuracy of their ship chronometers, but can, if they wish, check up almost hourly with these official measurements of time, and anyone else, no matter where he may be, may also take advantage of this vastly important service. It is in order to acquaint our readers with the story that lies behind the dials of our clocks, that NATURAL HISTORY has asked Captain Hellweg to tell of the activities of the United States Naval Observatory in this enormously important work.—THE EDITORS.

IT would undoubtedly surprise the citizens of the United States to learn how diversified are the various activities of the Naval Observatory.

Probably the one activity which is best known in this country is that of determining and broadcasting the nation's time. There is hardly any one who has not at some time seen a clock in some public office with the well known blue sign, "U. S. Naval Observatory time."

If you should visit some small, isolated telegraph station out on the western plains about the time that the tick comes in by wire, you would be surprised and probably much amused at the intense interest shown in the time and the heated discussions that occur over whose watch is nearest right.

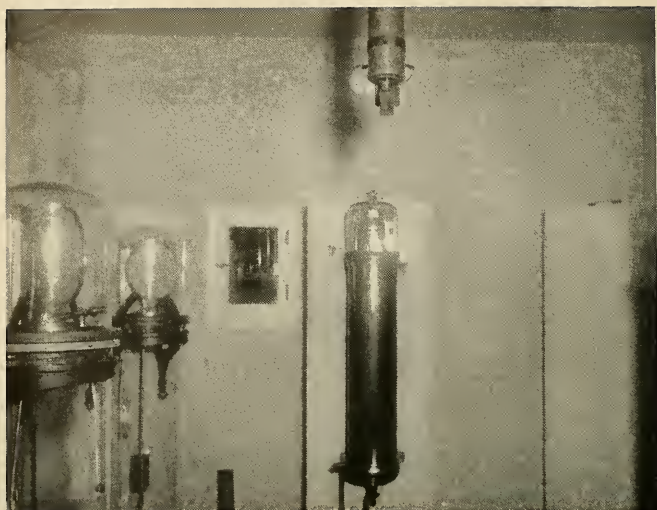
How many times a day do you think some one asks, "Please give me the correct time?" You know the Western Union Telegraph Company had to stop answering that question because it was interfering so seriously with their legitimate business.

The French have recently invented a telephone robot which automatically gives everybody the time. All you need to do is

to call a designated phone number and as soon as the connection is made, this automatic device gives you the exact hour and minute of the day. But the expense of such an apparatus must be tremendous, and the question is whether the expense of maintaining such an apparatus is warranted.

The history of time determination and of the maintenance of time extends back for centuries, long before clocks were ever known, but unfortunately this article is too limited to devote space to a discussion of the history of time.

The most accurate timepiece in the world is the earth. That may sound astonishing, but it is nevertheless a fact. The accepted basis for time measurement is the earth's rotation on its axis. The rate of the earth's rotation is assumed to be uniform, although it is affected by several factors which need not be discussed here. This rotation of the earth causes the sun, planets, and stars to appear to cross the sky from the east to the west. If you were located on the earth's equator and measured the time between the successive passages of some distant star over your meridian, you would have the interval



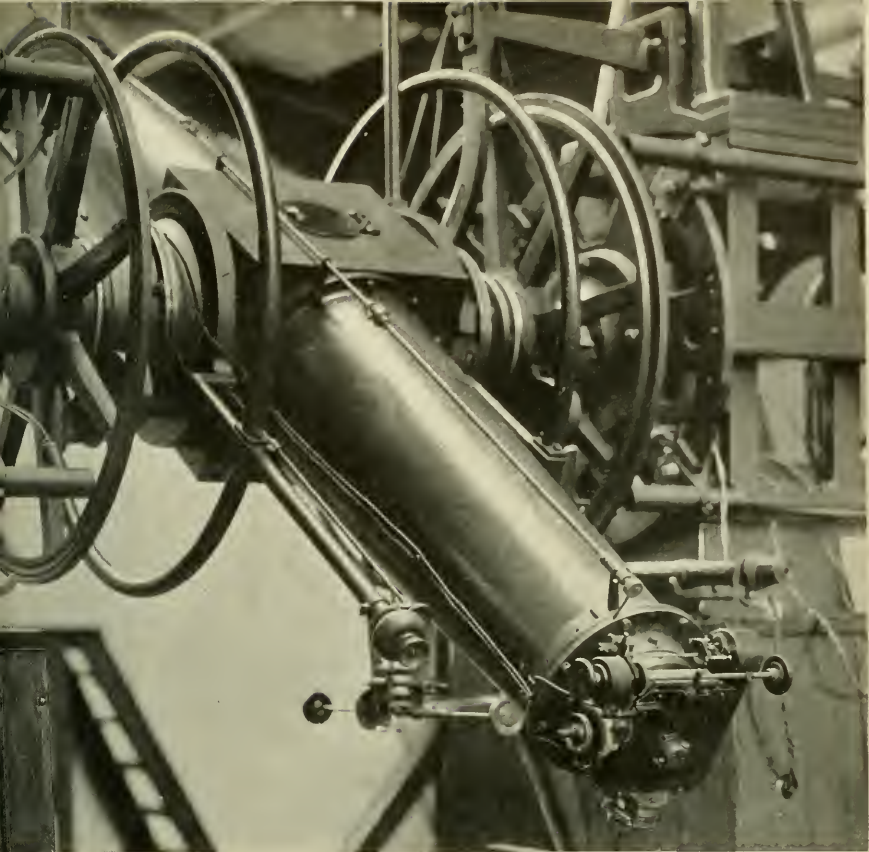
The inner chamber of the new clock vault. This carefully designed room is safeguarded in every possible way from changes in temperature. The observers do not enter the room in order to read the clocks, but, instead, look at them through the inverted periscope shown at the top



The "photographic zenith tube." A series of photographs of heavenly bodies is made automatically by this instrument, and, by careful measurements, the time is determined with extraordinary refinement

At the United States

The scientific observations requisite for the accurate determination of time are, so far as the United States is officially concerned, carried on in the Naval Observatory, where a corps of scientists is constantly engaged on the problem



Naval Observatory

The large picture above shows the six-inch transit, with its synchronous motor-driven impersonal micrometer. The house in which this instrument is installed is shown at the right



which accurately measures the period of the earth's rotation, or one day. If you then made the same measurements, using the sun instead of a star, your result would differ about four minutes from the star interval. This difference in the interval for the earth's rotation as measured by the star and by the sun is due to the earth's motion around the sun. This continuously changes the apparent place of the sun among the stars. Thus, during the course of a day, the sun appears to move a little to the eastward among the stars so that the earth must rotate on its axis through a little more than 360° in order to bring the sun overhead again. Even if the earth did not rotate at all on its own axis, the sun would rise and set once during the year because of the earth's journey around the sun. However, the stars are not within our orbit and, as they are millions of times more distant than the sun, their apparent positions are only very slightly affected by the earth's motion in its orbit.

MEAN SOLAR TIME

The apparent positions of the stars in the sky are reckoned with reference to an imaginary point in the heavens called the "vernal equinox." The vernal equinox is the intersection of the celestial equator and the ecliptic. The sun is at the vernal equinox at the beginning of spring. At that time it passes over the earth's equator on its journey northward. The period of time of the earth's rotation measured with respect to the vernal equinox is a sidereal day. The period of the earth's rotation measured with reference to the sun is called "an apparent solar day." The sun and the equinox move at variable speeds among the stars, and consequently the apparent solar and sidereal days are of variable lengths. In order to overcome this irregularity and to permit mechanical clocks to be made which can keep time accurately, astronomers had to have recourse to a fictitious time called "mean time." Mean solar time, which is the time generally used in ordinary life, is sometimes ahead of apparent solar time and some-

times behind it. The difference between these two times is called "the equation of time" and its maximum value is a little over sixteen minutes.

STANDARD TIME

Owing to the differences in geographical position, the sun naturally cannot rise and set in different parts of the world simultaneously. From this it is evident that the various parts of the world have different solar time. In order to reduce confusion and to establish a standard measure of time, an international convention established what is known as "Standard Time Zones." All points in each of these zones use one uniform time. This standard time cannot differ from the apparent local time by more than one half hour. In the middle of each time zone the local apparent time is exactly the same as the standard time. The width of each of these zones is 15° . If you divide 360° (which is the value of a total circumference), by 15° , you will find that it gives you exactly 24, which is the number of hours in a day. These standard time zones make it possible for the Observatory to broadcast the nation's time for the fifth time zone, or what is known as the 75th meridian time. The United States covers plus 5, plus 6, plus 7, and plus 8 time; that is, five hours, six hours, seven hours, and eight hours after Greenwich which by international agreement is considered the prime meridian of the world.

By this zoning arrangement, those who receive the time signal by radio all catch the same signal, and the one who lives in the sixth time zone, or approximate longitude of 90° , knows that his time is one hour earlier than the Washington time, or the 75th meridian time. In the same way, any one receiving the signal in San Francisco in the eighth time zone knows that his time is three hours earlier than 75th meridian time. This arrangement permits the Naval Observatory to broadcast signals all over the world, and any vessel at sea picking up the signals knows the exact time for the 75th meridian

and at Greenwich. Knowing the exact Greenwich time, he can make his astronomical observations and determine his exact longitude.

In order to assist you, the following tabular form is given:

GREENWICH Hour	STANDARD TIME			
	EASTERN	CENTRAL	MOUNTAIN	PACIFIC
0	7:00 p.m.	6:00 p.m.	5:00 p.m.	4:00 p.m.
3	10:00 p.m.	9:00 p.m.	8:00 p.m.	7:00 p.m.
5	Midnight	11:00 p.m.	10:00 p.m.	9:00 p.m.
8	3:00 a.m.	2:00 a.m.	1:00 a.m.	Midnight
12	7:00 a.m.	6:00 a.m.	5:00 a.m.	4:00 a.m.
15	10:00 a.m.	9:00 a.m.	8:00 a.m.	7:00 a.m.
17	Noon	11:00 a.m.	10:00 a.m.	9:00 a.m.
21	4:00 p.m.	3:00 p.m.	2:00 p.m.	1:00 p.m.

DETERMINATION OF TIME

The time determination made at the Naval Observatory must be made with the highest precision possible. Every clear day and night the astronomers at the Observatory repeatedly observe the sun, stars, and planets with the telescope so mounted as to permit movement in the meridian but not at right angles to the meridian. This telescope so mounted is called "a meridian circle" or a "meridian instrument." The difference between these two is that the meridian circle permits the measurement of the declination of the celestial body while the meridian instrument does not.

For a number of years the observations for the determination of time were made visually and the times of the transit of the celestial bodies were recorded by a chronograph. Quite recently, the Naval Observatory developed a new method in the determination of time which has proved very satisfactory. It eliminates the possibility of error due to the personal equation of the astronomer making the observation. After about a year's experimentation with an instrument which had been modified to serve its new purpose, we now make all observations for time photographically. The instrument used is a photographic zenith tube. As its name indicates, it is a tube rigidly fixed in the zenith. It therefore cannot photograph any bodies except those

which pass very near the zenith and which therefore come within its field.

The lower illustration on page 48 shows the upper end of this photographic zenith tube. At the lower end of this tube is a basin filled with mercury. The light from

the celestial body being observed passes through the lens at the upper end of the instrument and continues on down through the tube to the surface of the mercury. There it is reflected and comes to a focus on a small photographic plate located just below the lens. A series of photographs are automatically made, the plate is measured, and the time is determined with inconceivable refinement. Of course for the average citizen this refinement may appear to be excessive and unnecessary, but do not forget that in addition to catering to all the demands of the citizens of the United States, the Naval Observatory's output is used in every scientific endeavor where time becomes a factor.

THE CALCULATION OF TIME

Observations of the sun are not so precise as are those of stars. Moreover, it is possible to observe a number of stars during one night and thereby increase the accuracy of the work, as averages eliminate or reduce possible individual errors. But in order to make the star observations of value, it is necessary to know the positions of all of the stars in the sky. They must therefore be measured from the vernal equinox. Since the relative motions of the sun and earth fix the position of the vernal equinox, it is apparent that solar observations are therefore a prime requisite. By observing both the sun and the stars regularly over a period

Brown Brothers Photo

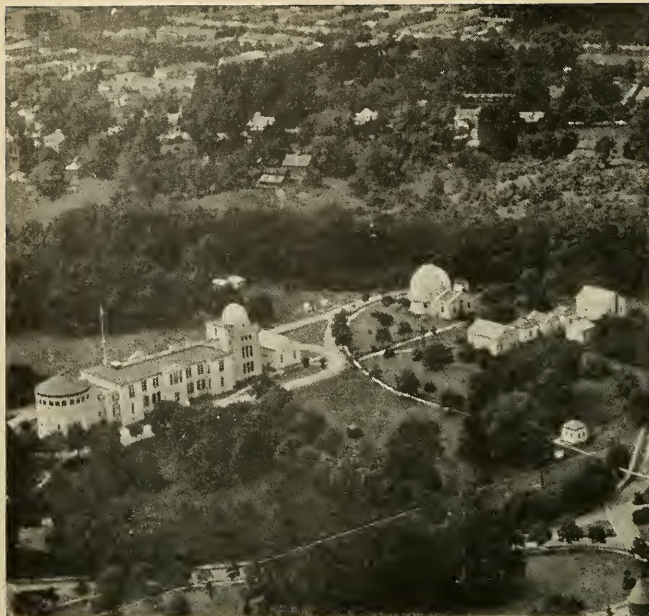
U. S. Naval Observatory

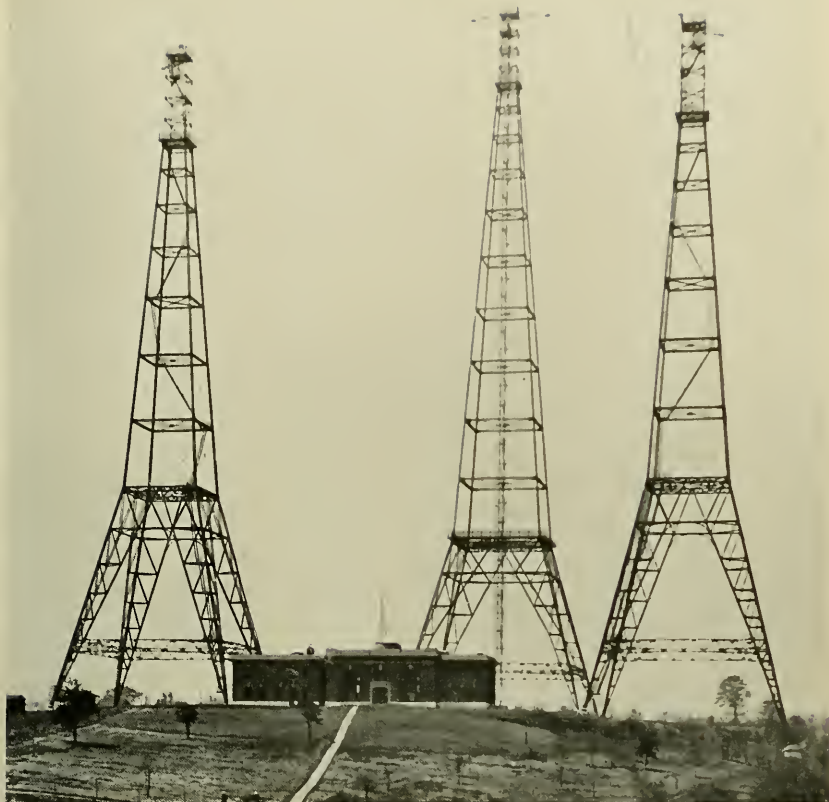
Operated by the United States Navy, and situated in the city of Washington, this institution is the American authority on time

Greenwich

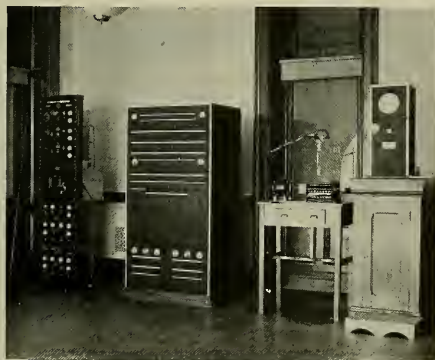
The longitude of the world is almost universally reckoned from the meridian marked by this institution. Built in 1675 for the advancement of navigation and nautical astronomy, this observatory has played an enormous part in the development of these sciences. The accurate determination of time is an important part of this work

Ewing Galloway Photo





By Burton Holmes from Ewing Galloway



Robot and Radio Towers

The small picture shows, from left to right, the oscillator, the special switchboard, and the electrical broadcasting "robot" at the United States Naval Observatory, which regulate the sending of the time signals from the Arlington Radio Towers, shown above

of years, it is possible to determine their relation very accurately, and the results of a long series of observations extending over many years are utilized in making the calculations for the reduction of a single night's time observations. The Naval Observatory therefore must maintain a regular program of observations of the sun, moon, stars, and planets.

TABULATED DATA

All of these observations are reduced and tabulated. This tabulated data is published annually in two volumes. The large one, called *The American Ephemeris and Nautical Almanac*, contains all the information which is valuable to astronomers and scientists. It gives all the computed positions and motions of all the more important celestial bodies. This book is an absolute necessity in all scientific and astronomical research work. In addition, a second and smaller volume is called merely *The Nautical Almanac*. It contains the tabulated data of the more important celestial bodies which are used by navigators throughout the world for the safe navigation of their ships.

Before leaving this subject, let me impress upon you that if the *Nautical Almanacs* by some trick of magic could all be removed from all of the ships tonight, few ships would dare go to sea tomorrow, for without the *Nautical Almanac* they could not determine their positions at sea accurately and expeditiously, and therefore the ships could be navigated to their destinations only with considerable risk. So when you drink your morning coffee and sweeten it with sugar, remember that if it were not for the *Nautical Almanac*, the coffee and the sugar could not be brought to America except at great risk and slowly. The insurance rates and freight rates would be excessively high, and few people could afford the luxuries or the so-called necessities imported from foreign lands.

In describing the determination of time, it was stated that while the photographic zenith tube is photographing the celestial

body crossing the meridian, the clock times for each exposure are recorded automatically. By means of an electrical chronograph, records are made of both the clock ticks and the signals from the photographic zenith tube. By this means, the clock time can be determined within one-thousandth of a second. A comparison of these clock times with the theoretical times computed from the observations determines the errors of the clocks. As the times for the transit of stars are most conveniently computed by sidereal time, the standard clocks at the Observatory are rated to run on sidereal time. These precision timepieces are expensive, elaborate, and must be maintained under the most ideal conditions possible. They are of special design and are made for extraordinary precision. In order to insure the greatest possible accuracy, these clocks must be maintained at a constant temperature and under a constant air pressure. They must never be disturbed. They are never reset, nor are they interfered with in any way, except infrequently when it is necessary to effect repairs. The actual rates of each clock are not so important provided that each is nearly constant. Day by day the rate of each clock is very accurately checked by the astronomical observations described before, and the errors of these clocks can be predicted for any time in the near future. As a result of the refinements in all steps in the determination of time and the maintenance of accurate time, the clock rates of our sidereal clocks can be predicted within a few thousandths of a second per day.

CLOCK VAULT

About two years ago, in an effort to increase the accuracy of the nation's time, a new clock vault was constructed.

On board our battleships, the most carefully guarded compartments are the powder magazines. They are safeguarded in every conceivable way. Therefore, when deciding to build a more accurate, more efficient clock vault, it was decided to construct it like

the magazine on a battleship. Then, in order to maintain a constant temperature, it was decided to put this vault in a thermos bottle; and then, in order to reduce the outside variations to which it was subjected, to sink it in the ground below the frost line. The result of this decision was to construct a compartment 12 ft.×18 ft.×9 ft. inside of another compartment completely surrounding the inner one and separated from it by a 2½-foot air space. All walls were built of special material to reduce radiation and to insure constant temperature.

INSURANCE AGAINST DAMPNESS

Again we turned to the Navy's long-established practices in order to insure against dampness or moisture. Each layer of moisture-proofing material was painted on in the successive steps with the Navy's well known bitumastic paint.

The illumination of the inner compartment is effected by typical battleship magazine lights, one of which can be seen in the illustration on page 48 up near the top of the compartment. The illustration shows the individual piers to which are secured the precision timepieces. The one in the center is a Shortt clock, manufactured in England. The two to the left are Riefler clocks of German manufacture.

Please note that in the arrangement of the clocks, no two clocks are mounted so that their pendulums will swing in the same plane. This idea was taken from the U. S. Naval Powder Factory, where the buildings were so constructed that each dry house is in the dead angle of all adjacent houses. In order to eliminate the possible sympathetic influence of pendulums swinging in the same plane, all piers are set at different angles so that adjacent pendulums are swinging at angles not less than 45° from each other.

At the top center of the photograph can be seen the lower end of the periscope. In order to make it possible to inspect all clocks visually daily, a periscope from one of our old submarines was obtained from the Portsmouth, New Hampshire, Navy Yard, and

was mounted as shown. This makes it possible for those in charge of the clocks to look down from the office above; and, by turning the periscope, to inspect each clock in turn. In other words, we have reversed the use of a periscope so that instead of looking from the bottom up for something on the surface of the sea, we are looking from the top down to see whether our clocks in the vault below are operating properly.

In the roof of the vault there are two electric controls and in the back of the vault, next to the Shortt clock, is a small compartment let into the back wall which contains another thermostatic control.

The outer compartment is heated by gas and has its own thermostatic control. The inner compartment is heated by electricity and the super-refinements of temperature control are effected by a very delicate thermostat in the left back, near the floor level.

As a result of the construction of this new vault, our temperature curves are straight lines and have been ever since the new vault was placed in commission. With such ideal conditions, it is not surprising that we have clocks that have not varied five thousandths of a second a day in six months.

TIME SIGNALS

Although sidereal time is most convenient for the use of astronomers in connection with their star observations, this is not suited for the general use of the public. The mechanism for the transmission of our time signals is therefore rated to mean solar time.

Four years ago the Naval Observatory broadcast three time signals daily. In 1932 this was increased to six signals daily. Recently, as a result of an invention made at the Naval Observatory, it is now possible for the Naval Observatory to broadcast signals hourly. Unfortunately, official broadcasting occupies the time so fully that there are four hours a day when it is not possible to obtain the necessary time to broadcast our time service. This results in the Naval Observatory sending out an hourly broadcast except at 9 A.M., 11 A.M., 9 P.M., and



Without the accurate determination of time the railroads of the world could not possibly operate the intricate structures they have developed

*Courtesy New York
Central Railroad*

Railroads

Every day the arrival and departure of thousands of trains are checked by the watches of thousands of railroad employees. These watches, in turn, are checked against the railroad's official time, which is determined, for the United States, by the scientists of the Naval Observatory

Ewing Galloway Photo





Ships depend upon time not only for the scheduling of departures and arrivals, but also for the determination of their positions when they are at sea

*Courtesy Cunard-White
Star Line*

Steamships



If accurate clocks at two points on the earth's surface show a difference of one hour in time, the navigator knows that the difference in longitude is fifteen degrees. The determination of longitude, consequently, resolves itself into a problem of time. The navigating officer accurately determines the time for his meridian of longitude by taking a "sight" of the sun or a star. His ship's chronometer tells him what time it is at Greenwich. The difference between the two can readily be translated, at fifteen degrees to the hour, into longitude

*Courtesy Cunard-White
Star Line*

11 P.M. This new device developed at the Observatory performs automatically what previously required an astronomer at least fifteen minutes to do before each broadcast. At that rate it would have been impossible, without enormous increase in the personnel, to have broadcast signals more frequently than six times a day. But with this new time broadcast robot, time comparisons instead of requiring fifteen minutes, now require less than five seconds, and after correction, the robot automatically broadcasts signals every hour on the hour.

As there are many of the readers of NATURAL HISTORY MAGAZINE who will undoubtedly want to hear the signals over the air, a brief description is given so that one can identify the signals.

Beginning at the 55th minute of each hour, exclusive of the excepted hours already mentioned, there is an audible signal—a birdlike chirp—for each second of the minute except the 29th second of each minute. This silent second acts as a sign post indicating that the next audible signal is the 30th second of some minute. At the end of each minute, there is a period of silence for the 56th, 57th, 58th and 59th second. This is called the "end-of-the-minute" silence and acts as a pointer so that the next audible signal is known to be the 60th second of some minute. Between the 50th and the 55th second are what we call "the identification silences." The 50th second is always audible. If you note a one-second silence followed immediately by the next four audible seconds which in turn are followed by the end-of-the-

minute silence, that indicates that there are four more minutes to go before the zero hour. If you hear the 50th and 51st audible seconds, then a silence, and then an audible 53d, 54th, and 55th second, that indicates three more minutes to go before the zero hour. If the 53d second is silent, you will hear the 54th and 55th, indicating two more minutes to go, and if the 54th second is silent, you hear only one, the 55th second, before the end-of-the-minute silence, indicating that there is only one more minute to go. During the 59th minute, there is a complete silence from the 51st to the 59th second inclusive. So if you hear a long silence of nine seconds' duration, you will know that the next signal you hear will be the zero hour.

During the transmission of the time signals, the radio stations at Arlington and Annapolis are automatically controlled by the private wire from the Naval Observatory. The San Francisco signals are indirectly controlled from Washington and rebroadcast from that station. One of the new broadcasting devices has been installed at Mare Island and permits them to synchronize their broadcast with the radio reception from the Naval Observatory. Congress has been requested to supply funds to construct two more of these time broadcast robots, one for installation at Honolulu and the other at the Canal Zone.

Time signals were first broadcast in order to aid navigators. Years ago the navigators were compelled to compute their errors while at sea and could only compare their chronometers when their ships were in port and

TABLE ILLUSTRATING THE AUDIBLE AND SILENT SECONDS OF THE TIME BROADCAST

MINUTE	SECONDS OF THE FIVE MINUTE BROADCAST											
	50	51	52	53	54	55	56	57	58	59	60.	
55	—		—	—	—	—					— (Four to go)	
56	—	—		—	—	—					— (Three to go)	
57	—	—	—		—	—					— (Two to go)	
58	—	—	—	—		—					— (One to go)	
59	—										—	

EXPLANATION:

— Indicates an audible signal of standard duration.

— — Indicates the final signal, the zero hour signal, of double duration.

Blank spaces indicate omitted signals, silent spaces used as identification signals.



Brown Brothers Photograph

Time Ball

Before radio was brought into play, many cities supplied a daily check on the clocks by means of a "time ball." This ball was pulled to the top of a pole which usually was so placed as to be visible at considerable distances. By means of an electrical contact, the ball was released at an exact time announced in advance—usually at noon—and observers, by watching for the dropping of the ball, could set their timepieces accordingly.



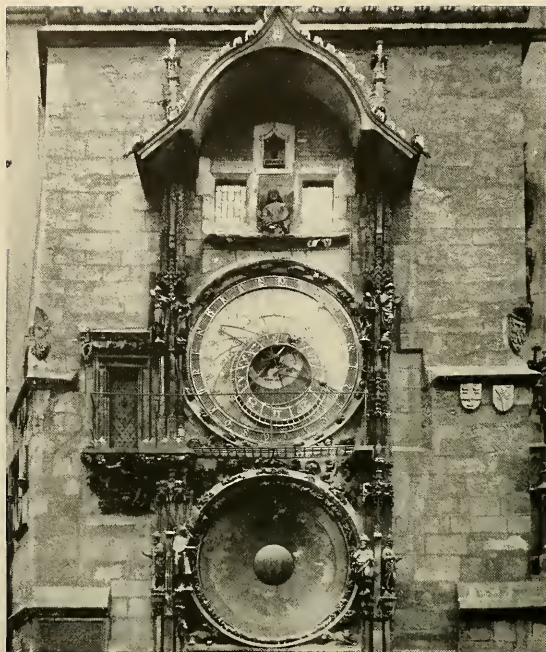
Brown Brothers Photograph

Sundial



*Brown
Brothers
Photograph*

Hourglass



Great ingenuity has often been exercised in the design and construction of clocks. This old clock in the town hall of Prague, Czechoslovakia, was built in 1840. When it strikes, the figures of Christ and the twelve apostles appear in the upper window, while the movements of the planetary system are recorded, and a calendar is also included

Thirteen clocks in one. The central dial gives the time at New Orleans, Louisiana, where this clock is located. The twelve small dials show the corresponding time at twelve other cities of the world. Even a casual examination of the various dials will show, however, that some of them are not absolutely accurate

Ewing Galloway



they could hurry to the nearest Western Union Telegraph office and get the noon tick.

In the spring of 1904 the Navy developed its first radio broadcast of time signals. At that early date the broadcasts were necessarily on low power. In 1912, upon completion of the Arlington high power radio station, the Navy inaugurated its high power radio time service.

It should be a matter of considerable pride to all Americans to know that the first American time signal radio broadcast antedated that of the British government by nineteen years, and that the first American high power time signal broadcast antedated the British high power broadcast by fifteen years; in other words, the United States was broadcasting accurate time on high power radio eleven years before the British government began low power time broadcast through the agency of the British Broadcasting Company. This interesting piece of comparative data was taken from the official reports of the Greenwich Observatory in the year 1923, and the later report of 1927.

Of course everybody realizes the vital importance of accurate time signals to the ships navigating the sea and also the importance to our elaborate railroad systems throughout the land. But there is hardly any one who appreciates how the demands of scientific and commercial activities have increased in recent years. Many special uses of the time signals have arisen. These include all of the longitude determinations for precise surveying and for map making. It is interesting to know that gravity determinations by which hidden deposits of oil and minerals are located are dependent upon the time service. Radio monitoring stations are also dependent on our signals, and the seismologists must have our signals in recording and measuring their earthquake tremors.

As a matter of fact, time is such a vital factor and enters into so many important activities in our present everyday life, that the Naval Observatory's time service is just about as important to the national life as the nervous system is to human life.



A Summer Home in Main Street

How a colony of purple martins, largest of the swallow family, takes up residence in the midst of city traffic every year during the nesting season

by
Herbert S. Ardell

SAUNTERING along a few yards below the central square in the city of Harrisburg, Pennsylvania, I noticed a large bird house, containing forty compartments, on a pole some eight to ten feet high erected at the curb. Each cell was occupied. The parent birds were flying unconcernedly amidst the hustle and bustle of street and sidewalk traffic—busy rearing their young.

I learned that on this location the ancestors of this colony of martins began nesting sixty years ago in the wooden awning which extended from the building to the curb line. The late Mr. E. Z. Gross, former Mayor of Harrisburg, purchased this property when he was Commissioner of Parks, and decided to remove the unsightly awning; but, being a bird lover, he did not want to deprive the martins of their nesting place, so he set up this veritable little apartment house for them.

It is rather curious that they would have nothing to do with their new home until some of the boards from the old nests were placed in the new-fashioned domicile for them to alight on.

The time of their arrival in the spring is about the fifth to the tenth of April, when an advance guard of several birds inspects the house. Having satisfied themselves that all is well, these birds leave. In two or three days they return, bringing with them the other birds that comprise this community.

They immediately start to clean house, throwing out all the old material, and begin constructing new nests of straw, twigs, and feathers. Usually four pure-white eggs are deposited and a single brood is reared.

The older birds are very quarrelsome among themselves, and often, when the parents seem to be settling disputes, the young birds are pushed out of their nests before they are able to fly. However, the parent birds are most assiduous in caring for their young.

During the nesting season, the martins remain in the boxlike quarters at night, but after the young are able to fly about, they all leave the house and thereafter spend the nights in dense thickets, and leave with the first appearance of dawn.

Years ago the purple martin nested in hollow trees or in any crevice which would make a suitable nesting place, and it still does so to some extent in certain sections of the country. In this region it has more readily adapted itself to civilization and seems to like a custom-built roof over its head.

Ruskin refers to the swallow's mouth "as a net for the catching of gnats," but this pictures a bird with its mouth constantly open, whereas the members of the swallow family snap at flying insects, and the glutinous saliva in the mouth keeps previous captures from escaping. Ruskin no doubt referred to the European goatsuckers or nightjars, which have a fringe of long bristles along the edge of the bill, thus making a regular insect net. The martin has been accused of catching the honey bee. John Burroughs, in one of his volumes, says "I doubt his guilt."

This largest of our swallows is a welcome guest whose arrival with its young in the springtime is eagerly anticipated, joyfully greeted, and whose departure the latter part of August leaves one as the French say—*au désespoir*.



A Curbstone Apartment

Undisturbed by the city's roar, a colony of purple martins takes up its house-keeping duties each spring in the same quarters in one of the busy thoroughfares of Harrisburg, Pennsylvania

Machu Picchu

The most famous Inca ruin
has again been cleared by
the Peruvian government
as part of the archæologi-
cal celebration of the dis-
covery of Peru

by

Wendell C. Bennett

Assistant Curator in Anthropology,
American Museum

FOUR hundred years have passed since the first Spaniards landed in Peru under the leadership of the dauntless Pizarro. The Inca Empire at that time extended from central Colombia to southern Chile, including all the present countries of Peru and Ecuador and parts of Chile, Bolivia, Argentine, and Colombia. The center or capital of that vast empire was the mountain city of Cuzco. There the Incas had formed their first organization, gradually spreading their military control in all directions. It took the Spaniards only a few years to establish colonial settlements in most of the principal Inca centers.

In commemoration of the discovery and conquest of Peru an extensive program of archæological investigation was inaugurated last year under the leadership of Dr. Luis E. Valcarcel, director of the National Museum of Peru. This program not only included exploration and excavation, but



also judicious reconstruction. Naturally enough the concentration of this work was in the Cuzco section.

As many as eight hundred men were employed, not only in the town of Cuzco itself, but also at the fortress of Sacsahuaman, and down the Urubamba river valley at Ollantaytambo and Machu Picchu.

Most of the ruins in Peru have been known for many years. It is true that only a few have been studied intensively, but accounts of varying degrees of accuracy can usually be found in the records of travelers and explorers dating back to the early colonial days. Machu Picchu is an



Aerial Explorations, Inc.

Half Hidden by Vegetation

Just twenty years after the ruins of Machu Picchu were first exposed to the light by Dr. Hiram Bingham, the heavy underbrush had again almost covered them over. This aerial view taken two years ago shows the naturally protected ridge site of the fortified town



The Village

A semicircular temple in which the stone blocks are cut, dressed, and fitted into a curved wall is shown at the left. This is one of the rare features of the Machu Picchu ruin



Below: A doorway with the inset ring stone above, and the cut-out pegs at the side to which a plank door might have been fastened

Above: Typical Machu Picchu wall of cut stone with inset decorative niches and projecting stone cylinders



Re-cleared

Above is a view of the ruins almost the same as the air picture on page 65, showing the complexity of walls and terraces revealed when the brush is cleared away

exception to the majority. Machu Picchu, if known to the early Spaniards, was never mentioned in their writings nor ever visited, all of which seems an oddity for so elaborate a ruin. The Indians living in the Urubamba region were no doubt familiar with the walls hidden by the heavy underbrush on that high ridge. However, in spite of such obscure scattered alternatives, it can be stated in all justice that the ruins of Machu Picchu were first discovered by Dr. Hiram Bingham in the year 1911.

A HIDDEN VILLAGE DISCOVERED

There are several factors that help explain why the ruins of Machu Picchu were overlooked until so recent a date. First, the Urubamba river valley is not favorable for travel. It is a deep gorge, narrowing to bottle-neck passages, with steep sides and practically no regular trails. The well-protected valley is semitropical in climate and even today supports a luxuriant undergrowth. The ruin is located on the ridge, and was formerly so covered with brush that no one suspected its presence. Furthermore, the Spaniards had a much better route into the interior by way of the pass of Panticalla, according to Doctor Valcarel, by which they were able to transport the coca leaf for trading with the Indians, and metals from the rich Vilcabamba mines. Finally, it is quite possible that the Indians were reticent about giving information as to the whereabouts of this once famous citadel.

The story of the discovery of Machu Picchu has been told by Doctor Bingham in the various reports of the Yale University—National Geographic Society expeditions. (*Machu Picchu*, Yale Press, New Haven, 1930, and "In the Wonderland of Peru," *National Geographic Magazine*, xxiv, No. 4, April, 1913.)

His exploration survey trip in 1911 went north from Cuzco into the Urubamba valley. The ruins of Ollantaytambo were examined and the trip continued. Six days' journey from Cuzco, an Indian resident volunteered to lead Doctor Bingham to a ridge below the

peak called Machu Picchu. The trip ascending the steep valley sides was arduous because there were no regular trails. Arriving at the summit, he could see the elaborate cut stone walls through the heavy underbrush which covered them. Preliminary examination and clearing of brush on this first trip of discovery were enough to convince Doctor Bingham of the importance of his find. A year later, in 1912, he returned for his extensive examination of the ruins. His work consisted largely of the terrific task of clearing off the underbrush. However, extensive excavation was also carried on. His plans and photographs are well known.

Machu Picchu is one of the few ruins at which the destruction by the hand of man was at a minimum. True, Indian treasure hunters had rifled some of the graves, but, on the whole, the plant life was the only active destroyer. For the first time a scientist was virtually the original excavator and describer. Here was an Inca village, still intact. Contrast this with the capital city of Cuzco, where Inca foundations support colonial Spanish buildings, where Inca coursed stone walls are completely plastered over; where, furthermore, continuous habitation makes destruction a perpetual element and creates obstacles for excavation and reconstruction.

AN INCA SITE

Machu Picchu was also important in presenting a unit type culture. While evidences of two periods are not lacking, the bulk of the material is typical of the Inca period, be it in masonry, pottery, or small artifacts. This situation, for example, is entirely reversed in the relatively near-by ruin of Ollantaytambo, where a great slab stone wall of pre-Inca (Tiahuanaco) style, is connected to a wall of Inca cut stone and backed by a late Inca or post-Spanish adobe construction. Although Machu Picchu was probably occupied for considerable time, no great changes in style are observable and the whole can be taken as a classic example of Inca culture at its height.

The ruins are located on a hog-back ridge between two peaks. The larger peak is called Machu Picchu, the "old peak," and the smaller is called Huaina Picchu, the "young peak." No name for the actual ruins is known. When Doctor Bingham first ascended the ridge, he virtually cut his own trail for the two-thousand-foot climb. After the ruins were cleared, a trail was made up the southern slope which was a never-ending zigzag. Last year the Peruvians straightened the trail and improved the grading so that today the ascent is easier. Two years ago I climbed to Machu Picchu on the old zigzag trail. My Peruvian guide talked while I panted. He said they had been considering a cable railway to aid the tourist, but that he was against the idea because he felt that the climb augmented the appreciation of the ruins. This was certainly true. After that climb one does appreciate the extensive worked stone constructions. In the old days there was probably a road, traces of which remain along the high ridges, and which quite possibly was part of the extensive communication system running out of Cuzco.

Machu Picchu site commands an excellent view of the Urubamba valley to the north and to the south. Investigation in the valley has shown that at one time it supported a large population. Agricultural terraces, aqueducts, house sites, village sites, and fortifications are common in the valley. In the Indian days, as at present, the lowland country was valued for coca (the narcotic leaf that the Indian is always chewing), chile pepper, cotton, as well as for the variety of fruits. It was not only for the products, however, that this section was so well protected. Fear of invasion from the interior undoubtedly stimulated the building of forts in various parts of this valley.

A FORTIFICATION

Machu Picchu was essentially a fortified village. The first impression of the site is that of a mass of terraces and buildings, completely covering the ridge, and all built

of well dressed stone blocks. More thorough examination reveals the defense features. The north side of the ridge is practically impregnable because of the steep slopes and sheer drops. Nevertheless, wherever possible, stone walls were built to augment the already precipitous slope. Two outer defense walls were built along the surrounding ridges, and to the south of the ruins. These were constructed of cut stone, and carefully aligned to enhance the naturally defensible contours of the ridges. On high points about the ruins were signal stations where observers sat watching for possible dangers. Even on the summit of the peak Huaina Picchu was a carefully constructed watch platform, 4000 feet above the valley. The slope on the south side of the ruins is less precipitous. Here agricultural terraces, stone faced and about eight feet high, formed a defense unit. Around the village ran an inner defense wall from fifteen to twenty feet high, and outside of this was a dry moat. The village itself was made of groups of houses, with their outer walls of solid stone.

HOUSES AND TEMPLES

The ruins very logically can be described in units. Some were temples, some houses. Some are on one level, some on another. The houses are divided by narrow passage ways. Every available place in the village, not occupied by houses, has agricultural terraces. Various levels, houses, and terraces are connected by stairways. Three groups are distinguished by their workmanship and position and considered as principal residences. The only frequent travelers in the Inca society were chiefs and messengers. Along every important trade route or roadway were resting places for food and lodging called *tambos* (or *tampus*). The important *tambos* had special residences maintained for distinguished chiefs. The "Palace" unit at Machu Picchu is probably one of these residences. It consists of two large rooms and two small chambers, all built around a central patio.



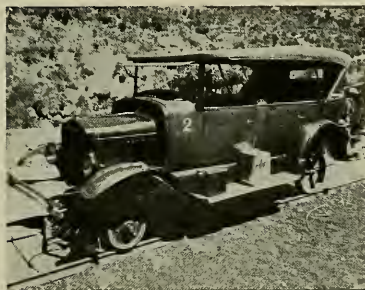
Base of a door "lock" over which was placed a slightly hollowed stone. The inset peg thus formed was built into the side wall of the doorway as a binding post for the door beam



Above: The *intihuatana* or sundial by which the seasons were accurately calculated. (Right): Drilled window ledge which Doctor Bingham associated with a temple for snake worship



Large natural rocks within the house walls were skillfully cut and utilized. The set shown at the right served as practical grindstones. This pair is the finest at Machu Picchu



Above: A cut stone wall in Cuzco overlain with a rough stone wall, which illustrates a technique and a confusion not found at Machu Picchu. (Left:) Modern transportation from Cuzco to Machu Picchu

Several units in the ruins can be considered as sacred places or temples. The main temple is located, roughly, about the center of the ruins, in what Doctor Bingham calls the Sacred Plaza. This temple or gallery had only three walls, that is to say, it was always open at one end. At the walled end at the back was a large block which probably served as the altar. Above this in the wall are seven inset niches between which are projecting stone cylinders. The side walls of this temple use massive blocks of stone in the construction. One stone measured thirteen and one half feet long and eight feet high. Even this large stone was carefully fitted with the small blocks above it.

Another temple is noteworthy because of three windows in a row, all with stone lintels. Since windows are rare in Inca construction, these are particularly interesting. A third temple group has the unique feature of a semicircular tower. This curved wall is made of blocks of carefully dressed and fitted stones. The wall curves into a horseshoe shape. Another such curved wall is found in the "Temple of the Sun" in the Dominican monastery at Cuzco, but their occurrence is decidedly rare. Connected with this semicircular tower is a plain, straight-walled room. In the curved wall are six inset niches and two windows, and in the straight walls are twelve inset niches. This temple shows no evidence of ever having been roofed over. Below this last unit, which stands on an outcropping natural rock, is a large cave, carefully carved with deep niches and benches. It has been considered the most likely place for interring the important dead.

THE SUNDIAL

Located on a cleared rock formation is a large stone, cut flat on top with a projecting prism from the center. This was the "*intihuatana*" or sundial. Once this was carefully marked so that the shadow of the prism on the flat rock indicated the solstices and equinoxes. In an agricultural community calendrical knowledge is of great importance.

Many of these sundials have been found in Inca ruins.

All the Machu Picchu houses are built of stone with thatched roofs, and two-story houses are found, which is quite uncommon. The end walls of the house are built up to a triangular peak which forms the central gable. Projecting pegs alternate with inset ring stones for attaching the beams of the roof to which the thatch was fastened. This function for the stone cylindrical pegs on the roof section has been clearly demonstrated by Doctor Bingham, but the projecting pegs between the niches on the inner temple walls are more of a mystery. Doctor Valcárcel suggests that they might have been used for hanging the various *quipus*, or knotted string records.

FEATURES OF HOUSE CONSTRUCTION

The houses were decorated with inset niches on the inside, and many of them have windows. Most of the doorways are narrower at the top than at the base, a typical Inca style, and all have single stone lintels. The actual doors were probably made of split logs, tied together. Above many doors is an inset ring stone, and at the side is a cut-out peg, topped with another stone, which is usually called a lock. Doctor Bingham demonstrated one probable method of fastening the doors by means of a vertical log attached to the ring at the top, and a cross beam, tied to the side peg. Natural rocks within the house were cut and utilized rather than removed. Thus one set of natural rocks served as large grindstones.

Each group of houses has distinctive characteristics. Doctor Bingham describes one group which had a red clay plaster on the inner walls. Another had a group of terraces and gardens within the private house patio. Still another was featured with monolithic door lintels.

Most of the stone walls of houses and terraces show remarkably fine technique of manufacture. The stones are of medium-sized, well-cut blocks, laid in roughly horizontal lines. The masonry is not

coursed, but projections from one block fit into notches in another, thus forming a solid jointing. No plaster or cement of any kind was used.

Machu Picchu has been described as a city of stairways. The whole complex system of terraces, temples, and houses, running along an irregular and steep-sided ridge, is tied together with innumerable stairs. Three thousand steps were counted by one patient observer. Some of the steps are regular series of individual cut stone blocks. Some are more irregular, utilizing natural rocks and cut-out ledges. One set is monolithic, in that steps and sides are cut from one great rock.

THE WATER SUPPLY

Water was conducted through small stone aqueducts from springs on the mountain-sides, some at considerable distance. Once entering the ruins, the water was allowed to run over terraces and down steps. Eventually it ran into stone cut reservoirs, commonly called "baths." Water must have been a great problem at all times, because the aqueducts are small, and because many of the springs disappear during the dry seasons.

Although some of the more prominent personages possibly were entombed in important caves at the village, such as the one under the semicircular tower, most of the burials were found in caves on the slopes below the village. Excavation of these caves revealed bones in bad condition, and, buried with them, bowls and tools. The skeletons in better condition showed that the individual had been buried in a sitting position with the knees raised. Some of the skulls were artificially deformed, in accordance with Inca custom.

The discovery and description of this elaborate ruin immediately raised the question of the builders. Doctor Bingham in his researches came to the conclusion that the city was built by the old Tampu Tococo peoples as a city of refuge during the troublesome early years, and that later these same people returned to Cuzco and founded the

Inca Empire. The traditional basis for this story was taken largely from the account of Fernando Montesinos, an ecclesiastical lawyer who first came to Peru in 1629. The gist of the legend is that Pachacuti VI, 62nd chief (Amauta) of the early inhabitants, went with the scattered remains of his people to a place called Tampu Tococo, where he built a city of refuge against the serious attacks of the invading hordes. There they lived in a city where there was a large cave for preserving the remains of the ancestors, and houses with windows. After some five hundred years they again grew powerful, returned to Cuzco, and started the later Inca Empire. Traditionally the site of Paccari-tampu near Cuzco has been considered the town where Pachacuti VI led his people. But, as Doctor Bingham points out, neither cave nor windowed houses are found there, while both exist at Machu Picchu. This, plus the excellent isolated and impregnable position of the latter ruins, is the principal basis of his identification.

That a highland civilization of megalithic temple builders existed in Pre-Inca days is undisputed. The stone-pillared temples of Tiahuanaco in Bolivia, the base walls of gigantic stones in Saesahuaman fortress near Cuzco, the red sandstone slabs of Ollantaytambo, all are remnants of this period. The stone building civilization extended into northern Peru and Ecuador as well. However, the identification of Machu Picchu with this period is more difficult. In spite of the use of large stones in some parts of the ruins, the techniques which distinguish ruins of the earlier types are not found.

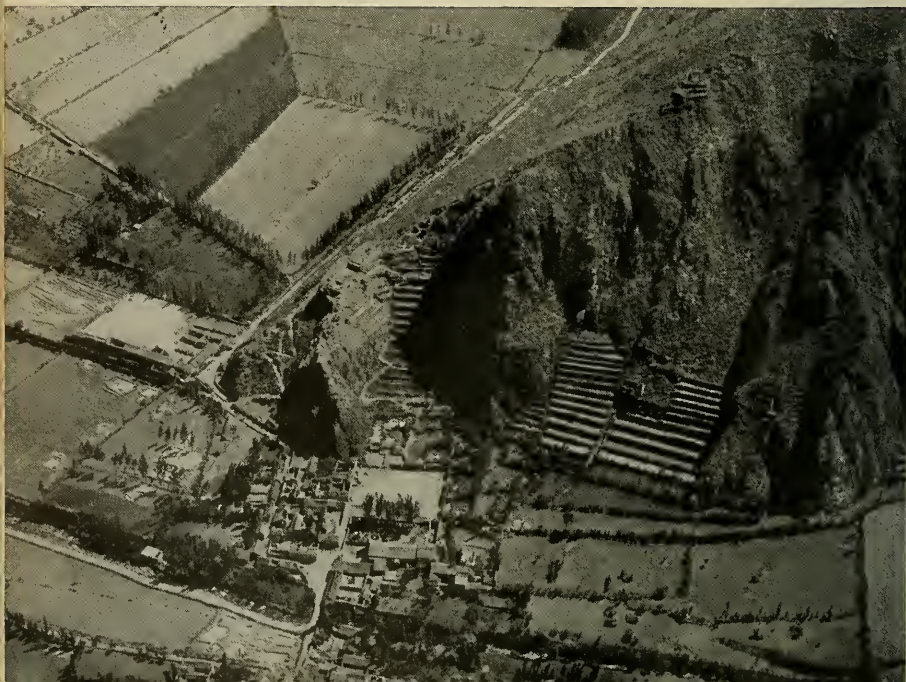
ALL MATERIALS TYPICAL

Pottery and tools found at Machu Picchu are clearly Inca in style, practically without exception, although Doctor Bingham does describe certain small stone counters, and "record" stones in the shapes of animals, which are not universally found with Inca associations. The so-called ashlar masonry technique is typically Incan and is found in many other sites. Most recently it has been

Cut stone terraces of Ollantaytambo ruin. The top wall has the inset decorative niches and a doorway in Machu Picchu style

An air view of Ollantaytambo village and ruins, not far up the valley from Machu Picchu. The modern village covers the site of the ancient one. The valley around this site holds many indications of the Inca civilization, such as elaborately cut rock formations, "baths," canals, and many terraces like those illustrated

Aerial Explorations, Inc.





A street in the town of Cuzco, flanked on both sides with Inca cut stone walls. Modern adobe walls are built on the ancient ones. This confusion of old and modern does not exist at Machu Picchu which remained isolated from all contacts until its discovery twenty-three years ago

Corner section of the base wall of Sacsahuaman fortress near Cuzco. Recent excavations of the Peruvian government have disclosed Machu Picchu walls as part of the interior structure of this ruin. The fortification walls, with their irregular but carefully fitted stones, indicate an older cultural strata

found as part of the inner structure of Sacsahuaman fortress. Even the excavation at Machu Picchu showed no great depth of culture. However, certain local peculiarities can be noted for the Machu Picchu ruins. The cylindrical projections of stone in the walls; two-story houses; many windows; abundance of stairways and terraces; open buildings; and three-sided temples open at one end, are all indicative, according to Doctor Valcarcel, of influence from the earlier period. However, the ruin of Ollantaytambo, not far away in the same valley, has definite sections which conform to the early period, and it is possible to account for some of the features of Machu Picchu through the influence of this site.

Ollantaytambo did not share the fortune of Machu Picchu in remaining undiscovered until recent times. It is still a pueblo with inhabitants who find it easier to collect than to cut building stone. This has been going on for years, and much of the ruins has been disturbed. Still it is one of the most interesting sites in the whole Cuzco region, because it presents evidence of several cultural periods.

The megalithic red sandstone wall of well cut and fitted blocks is in contrast to the style of the rest of the ruins. Six blocks form this wall. The average size of a block is about from five to six feet wide, more than twelve feet high, and about five feet thick. Thin, well fitted pieces of cut stone are inserted between these blocks to form the finished wall. Other walls and terraces near this are also made of large, dressed sandstone blocks. One block is cut into a set of steps. Some of the blocks have T-shaped grooves for joining with copper cramps. All work of this kind is suggestive of the early megalithic highland period.

Backing the megalithic wall is another of small fitted stones in typical Inca style. Along one side is a series of terraces constructed of dressed stone blocks, typical of the Machu Picchu style. The top wall of this terrace has inset niches and a large doorway with a stone lintel. Besides the well cut

stone terraces there are others of rough stone, probably of more recent construction. Recent work by the Peruvians at Ollantaytambo has furnished some evidence of stratification in these various building techniques. Their digging on the hill has exposed a small section of a wall of a building, of oblong, well squared blocks with polished surfaces, beneath the floor of a building which is of the later, rough stone, Inca style. Also, they have discovered stairways connecting the various terraces, and still deeper in the excavation, other stairways which apparently run under some of the present terraces, and thus represent an earlier period.

On the ridges above the ruins and in the valley below are many houses and walls of the rough stone and adobe type. Yellow paint finish is found on the inner walls. All through the valley are traces of Inca occupation. A cliff of outcropping stone is elaborately cut with niches, benches, and trails. Several "baths" are found cut out of solid stones, as part of a complex system of small canals.

Ollantaytambo obviously represents a site of long habitation through several changes of culture. Some day excavations should uncover a series of pottery types in a stratified refuse deposit. Pottery with shapes and designs of the early highland period has not yet been found in the Cuzco region. Such a discovery would be of great importance in the archaeological problem.

THE MACHU PICCHU JEWEL

The Peruvian government is doing important work on this problem, and perhaps when the results of their labors are studied and published, the chronology of Archaeology will be more fully understood. The work at Machu Picchu has been mainly one of clean-up and preservation. Still, it is interesting to read the opinion of Doctor Valcarcel, director of all the recent investigations; "Archæologically and artistically, Machu Picchu is today the most valuable gem of pre-Columbian American culture."

The Ellsworth Antarctic Expedition

The difficulties and delays that have beset Lincoln Ellsworth in his present attempt to cross the South Polar Continent



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BY the time this issue of *NATURAL HISTORY* reaches its readers, the newspapers undoubtedly will have published further accounts of the activities of the Ellsworth Antarctic Expedition. It is probable that the transantarctic flight will have been begun, and perhaps completed, with the result that another section of the great white continent will have been subtracted from the shrinking area of the unknown. As this article is being written, however, the expedition is awaiting improved weather conditions, in order that the preliminary test flights may be made before attempting the 2700-mile flight from Snow Hill Island, in Weddell Sea, across the Antarctic to the edge of the Ross shelf ice beside the Bay of Whales.

Reports from the expedition, sent by radio from Deception Island and, more recently, from Snow Hill Island, tell again of the difficulties that face the Antarctic explorer on this side of the great Antarctic continent. Where the Ellsworth Expedition's attempt of last year to fly from the Bay of Whales across Antarctica and back was brought to an untimely conclusion by the abrupt breaking up of the ice with consequent damage to the plane, the new attempt has been repeatedly

Lincoln Ellsworth, trustee of the American Museum and leader of the Ellsworth Antarctic Expedition, at the bow of the "Wyatt Earp"

balked, first by the bending of a connecting rod in the powerful motor of the plane, second by the melting of the snow on Deception Island making it impossible to take off, and third, by the snowstorms and other adverse weather conditions that have been almost continuous since the expedition transferred its activities to Snow Hill Island a hundred or more miles farther south.

As a result of the experience gained during the 1933-34 expedition, Deception Island was decided upon as this expedition's base. This plan, as Mr. Ellsworth explained in an article in the July-August, 1934, issue of *NATURAL HISTORY*, accomplished two things. First, it reduced by a hundred miles, or thereabouts, the distance the plane would have to fly, and at the same time increased by about 1300 miles the amount of unknown territory to be crossed by the flight. Where, in other words, a "round trip" flight of 2900 miles would have been made according to the 1933-34 plans, covering 1450 miles from the Bay of Whales to the head of Weddell Sea



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At Deception Island

Above is shown the "Wyatt Earp" which carried the Ellsworth Expedition to southern waters both for the 1933-34 expedition and for the current one. At the right, members of the party are fitting the plane with its propeller. The lack of a suitable runway from which to take off with this one-and-a-half-ton machine greatly delayed the expedition's work. These two pictures were received in New York in December, 1934



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North Graham Land

One of the numerous desolate islands of Antarctica. In the contemplated flight almost 2800 miles of these snowy wastes will be crossed

© *International News Photo*

Cliffs of Ice

A scene at Deception Island from which point the Ellsworth plane was to take off on the trans-antarctic flight. Rapidly melting snows on the island's only available runway, however, prevented this

© *International News Photo*



and the same distance back over the same route, the 1934-35 plans call for a flight of some 1300 miles from Snow Hill Island, to which the expedition has now moved from Deception Island, to the head of Weddell Sea, and in addition the 1450 miles from Weddell Sea to the Bay of Whales.

With Lincoln Ellsworth, Sir Hubert Wilkins, and Bernt Balchen as the principal figures in the expedition, it is obvious that every contingency will be met by men widely experienced in such difficult work. It is obvious, too, that if delays have occurred, it is because conditions in the far south, and especially in the Weddell Sea area, are extraordinarily difficult. As a matter of fact, the history of the exploration of Weddell Sea is replete with accounts of extraordinary adventure and heroism. The story of the Shackleton Expedition of 1914-16, which attempted to cross the Antarctic continent, is, perhaps, the outstanding story of heroism and difficulty in these frozen regions. Caught in the ice of Weddell Sea, where she was held prisoner for ten months before being crushed and sunk, the Shackleton ship "Endurance" played no small part in this amazing adventure. Left with only their small boats and with such supplies as they had salvaged from the wrecked vessel, the crew, under Shackleton's indomitable leadership, eventually reached Elephant Island, from which Shackleton himself, with five companions, set sail in a twenty-foot boat at the beginning of the Antarctic winter in an attempt to reach South Georgia where help could be enlisted in an effort to save the main body of the expedition who were left behind.

Having, after one of the most extraor-

dinary small boat voyages ever made in the history of the sea, reached South Georgia—having, in addition, with one of his five companions, actually succeeded in crossing the island's almost impassable mountains, this amazing leader was able to rescue his marooned expedition only after three desperate attempts had failed.

Antarctic exploration has progressed far since Shackleton made his gallant but ill-fated attempt, but not from that day to this has any effort to cross the Antarctic continent succeeded. Few explorers would care to face the hazards and the toil that such an undertaking requires, but Lincoln Ellsworth, who with Amundsen flew from Spitzbergen across the North Pole to Alaska, is now making his second attempt at just such a crossing. It is true that airplanes have come to take the place of dog teams and other simple equipment. It is true that a flight such as Ellsworth and Balchen are now about to attempt could succeed in fewer hours than Shackleton would have spent weeks. Yet the vast ice fields of the glacier-covered continent of the far south offer difficulties that exist nowhere else on earth, and even the improved equipment of the explorer of today gives him only a little advantage over the explorers of Shackleton's time. Difficulties such as rarely have to be faced by explorers elsewhere on the earth's surface are forever to be guarded against by the expedition that dares approach the icy Antarctic continent on its Weddell Sea side, and any success that is attained by those who attempt this most difficult of tasks, must, because of these very difficulties, bulk large in the sight of observant people.

Science in the Field and in the Laboratory

American Museum Activities,
Expeditions, Education,
Meetings of Societies,
and New Members

Edited by

A. Katherine Berger

given splendid coöperation, and the members of the expedition are quite hopeful that a number of entirely new types will be discovered

An Expedition to Burma

Explorations to study animal and plant life in the upper parts of the Chindwin River—deep in the hinterland of northern Burma—are to be undertaken during the early part of 1935 by an American Museum of Natural History expedition headed by Arthur S. Vernay, field associate of the department of mammals of the Museum.

The country to be studied is close to the border of southern China and has never been explored. In fact, the only white visitors to that region have been a few government officials and scattered military patrols. The expedition will collect botanical specimens, mammals, birds, and insects, and will also photograph various types of natives such as Kachins, Chins, Karens, and others, in conjunction with anthropological studies.

The government of Burma has permitted the expedition to collect all kinds of specimens of scientific value. Mr. Vernay started for India on December 4. He was accompanied by Mr. Harry C. Raven, associate curator of comparative and human anatomy, of the Museum. The formal title of the expedition, one of the many sponsored by Mr. Vernay on behalf of the American Museum, is "The American Museum of Natural History-Vernay-Hopwood Chindwin Expedition."

The outfit will leave Rangoon on January 8, where Mr. Vernay and Mr. Raven will be joined by S. F. Hopwood, chief conservator of forests for the Indian Government, and three members of the Bombay Natural History Society. After a rail journey which will end somewhere north of Mandalay, the expedition will push into the interior. It will be slow and strenuous going, even with the aid of some twenty natives and more than one hundred shan mules.

The expedition expects to be in the field about three months, and is not going to look for any one particular thing, excepting perhaps a new subspecies of tsine, an extremely interesting wild cattle of Burma. The expedition will be equipped to collect and to carry a large number of specimens. More than eighteen months were spent in preparation. The Bombay Natural History Society has

The Sage West China Expedition

Word from the field received from Assistant Curator T. D. Carter, under date of September 28, indicated that the Sage West China Expedition was at last on the collecting grounds and work was well under way. On that date the party was encamped in the Chen Lian Shan Range about 30 miles west of Wenchwan, at an altitude of 10,000 feet, well above timber line. Dense fog was hampering the hunting very badly, but on one clear day three blue sheep were secured. The fog, however, had not interfered with the trapping of small mammals, which in three days had yielded 63 skins.

Canadian Wood Buffalo

The Snyder Canadian Expedition for Wood Buffalo and Small Mammals, comprising Harry Snyder, leader, and George G. Goodwin, American Museum representative, returned to New York City on October 15, after having secured for the Museum 4 wood buffalo, 1 stone sheep, and 180 small mammals.

The wood buffalo were never very plentiful in the more recent times; the introduction of large numbers of plains bison, from the Wainright herd, into Wood Buffalo Park, has resulted in cross breeding and rapidly diminishing numbers of true wood buffalo. The group secured by the expedition will probably be the last to come out of the reservation that can positively be recognized as the typical specimens.

Mr. Goodwin left New York City on June 30 and arrived at Dawson Creek on July 6, then traveled up the Peace River seventy miles by boat to Hudson Hope, then, by pack train, four days' journey to Halfway River. After collecting here for three weeks he returned to Edmonton and left, by plane, on August 8, for Wood Buffalo Park, and was joined by Mr. Harry Snyder on August 13, at Pine Lake, summer range of the buffalo.

The first day on the buffalo trail the party met a Wainright bull, which charged through the middle of the outfit; later, they encountered many solitary old bulls and herds of 20 or 30 animals. Unfor-

tunately, none of these were wood buffalo with the exception of one enormous specimen which was collected, measuring over six feet high at the shoulders. The buffalo, at the time, were in the thick forest, driven there by bull-dog flies, which hang about in swarms. The animals do a great deal of rubbing and seemingly take especial pleasure in rooting out and tearing to shreds small spruce and pine trees. The rutting season was at its height, and, maddened by flies, the animals were extremely dangerous to hunt; furthermore, it was difficult to select suitable specimens in the heavy forest. The expedition decided to continue on its trip north and return in the latter part of September to secure the remainder of the group, when the animals would be in more open country.

Leaving Pine Lake, Wood Buffalo Park, on August 19, the party traveled north to Fitzgerald on the Slave River and then to Resolution on the Great Slave Lake; down the Mackenzie River to Fort Simpson, and on to the forks of the Nahanni and Liard rivers. From here they flew to the head waters of the Nahanni River in the high peaks of the Mackenzie Mountains, to get information on the reported black-tailed sheep. Though, from the air, sheep were seen on the mountain ridges, there was no landing place for the plane within 200 miles, but sufficient information was gathered to assure a successful trip here next year.

The next flight was to Fort Nelson and then northeast to Dorothy Lake, 400 feet elevation in the mountains. Here the men were fortunate enough to observe a herd of elk and also saw grizzly bear, small bands of caribou, and numbers of moose. Traveling by pack train, the expedition crossed the Muskwa and Prophet rivers and over the Caribou Range in a snowstorm, eventually arriving at Deadmans Lake, where the plane met them, and after a delay of three days, due to weather conditions, they returned to Wood Buffalo Park to complete the group. The buffalo were now moving to their winter range in more open country, and the party was fortunate to find a small herd of true wood buffalo, including cows and calves, on the salt plains.

Ellsworth in Antarctica

Lincoln Ellsworth's dispatch of December 2 from Snow Hill Island, Antarctica, (New York Times, December 3) calls attention to the 1901-03 work of the Nordenskjöld expedition on Seymour and Snow Hill islands. He relates that Dr. J. G. Andersson and Lieut. S. A. Duse, of that expedition, are supposed to have left a hut and valuable collections of fossil plants and other fossils on Snow Hill Island. Volume III (1916) of the publications of the Nordenskjöld expedition, contains reports on the rich Mesozoic flora (Jurassic) found at Hope Bay, Graham Land, and of a mid-Tertiary flora from Sey-

mour Island. These areas appear now at the margin of the great Antarctic ice sheet. During the Jurassic and mid-Tertiary times there were no near-by ice fields, for the land was then clothed with a rich temperate and subtropical vegetation. The list of Hope Bay Jurassic flora includes the following groups: Equisetales 1, Filicales 25, Cycadophyta 19, Coniferae 13, Gymnosperms 2. The ferns, cycads, and cone-bearing plants were thus well represented. The flora is correlated with the middle Jurassic flora of England and Europe and that of the upper Gondwanas of India. The Hope Bay plants constitute the first Mesozoic flora known from the Antarctic. This is of special interest in that the Mesozoic era is commonly known as the Age of Reptiles. One of its periods, the Jurassic, was characterized by the presence of huge dinosaurs, typified by *Brontosaurus* and *Diplodocus*, which fed upon the same sort of luxuriant vegetation in western North America and eastern Africa.

In this same volume Prof. Carl Winan describes the fossil remains of a large extinct whale, *Zeuglodon*, and various species of extinct penguins, all of which were collected by J. G. Andersson from the older Tertiary beds of Seymour island. These specimens indicate a climate somewhat like that which exists today on Antarctica. The next article by Dr. P. Dusen deals with a large mid-Tertiary flora from Seymour island. The plant list includes *Araucaria* and associated forms, which are more modern in aspect than the Jurassic flora from Hope Bay. They also indicate a much warmer climate than the present Antarctic one. The *Araucaria* are abundant today on the well watered western slopes of the Andes Mountain of southern Chile.

The presence on the one hand of numerous fossil plants of Jurassic and mid-Tertiary age on Seymour, Snow Hill, and other islands of the Antarctic archipelago, and the finding, on the other hand, of early Tertiary remains of whales and penguins, which may be associated with frigid conditions similar to the present, suggest that the Antarctic continent during past geologic ages has been subjected to a successive alternation of warm and cold climates, each phase of which embraced a vast extent of time. A tremendous amount of data is being collected by geologists, which would tend to show that these climatic changes were world-wide in scope, that the variations were more marked in the Arctic and Antarctic regions, less so in the temperate zones, and least of all in the tropics.

Lincoln Ellsworth's dispatch from Snow Hill Island is thus of vast import. The data which the Ellsworth and Byrd expeditions are now accumulating in widely separated parts of Antarctica should add much to our knowledge of the geography and variable climates of that vast region.

—CHESTER A. REEDS.

THE HAYDEN PLANETARIUM DOME, AMERICAN MUSEUM

Finishing the outer dome of the Planetarium. Here the concrete is being applied with an Akeley Cement-gun. After this process is completed the dome will be covered with copper

Photograph by
H. S. Rice



Astronomy

The attendance at the meetings of the Amateur Astronomers' Association has continued to be most encouraging during the fall. The average attendance is around two hundred, and the close attention to the lectures manifests the sustained popular interest in the study of astronomy.

On Tuesday, December 18, the Amateur Astronomers' Association gave the first of its 1934-35 series of radio talks over Station WOR from 4:15 to 4:30 P.M.

On December 19, Mr. Charles A. Federer, Jr., instructor of the advanced class of the Amateur Astronomers' Association, gave the first of his three talks on stellar diameters. On this occasion his subject was Luminosities and Temperatures; on January 2, it will be The Interferometer; on January 16, Giants and Dwarfs. All those interested are invited to attend this series of talks. The meetings of the Association are open to the public and visitors will be cordially welcomed.

Progress of the Hayden Planetarium

The building for the Hayden Planetarium is progressing rapidly. The outer dome is nearly completed with the exception of the copper covering. The application of the concrete with the Akeley Cement-gun has attracted much attention. Although this method was used in European planetariums, the dome of the Hayden Planetarium is the first one in America to be constructed in this way. An interesting coincidence is that the Akeley Cement-gun was photographed while in operation on the planetarium of the American Museum by an old friend of Carl Akeley, using an Akeley Camera.

Carl Zeiss, Inc., has promised to deliver the Projection Planetarium instrument before January 1, 1935, and J. W. Fecker has promised to have the Copernican Planetarium ready by March 1, 1935.

There is a possibility that the Planetarium may open as early as June 1, 1935.—CLYDE FISHER.

American Museum Guests

The American Museum is favored from time to time by visiting scientists from other countries who come to study its great and rapidly growing collections. The department of vertebrate palæontology has at present as a guest scientist Dr. L. D. Boonstra, who comes from the South African Museum in Cape Town, to study, especially, the American Museum collection of primitive South African reptiles known as the Broom Collection. Doctor Boonstra is making a thorough restudy and revision of this collection and has already prepared several papers on the results of his work for publication in *Novitates*.

Mr. Jesse L. Nusbaum, the director of the Laboratory of Anthropology of Santa Fé, New Mexico, has made his headquarters in the department of anthropology, American Museum, during a short visit following the annual meeting of the Board of Trustees of the Laboratory, which, for the convenience of its members was held recently at the Museum. One of the important objectives of the Laboratory of Anthropology is the coordination of anthropological work in Southwestern United States, the principal area of its activities. Consequently, the department of anthropology has worked in close cooperation with the Laboratory, and several joint archaeological projects have been carried through. The department is under special obligation to the staff of the Laboratory for cooperation in the preparation of an exhibit now in the Southwest Indian Hall, demonstrating the dating of archaeological ruins by correlation with the age of beams found in the ruins, according to the method devised by Dr. A. E. Douglass.

Wyoming Fossil Dinosaur Collection

The work of excavation at the now famous dinosaur quarry at Cloverly in the Big Horn Basin, Wyoming, was finished about the middle of November, and the collection, contained in 144 cases,

has arrived in the American Museum. Mr. Carl Sorensen of the palaeontological department laboratory, who has had direct charge of this field work under the supervision of Dr. Barnum Brown, has returned to the Museum, and it is expected that the task of preparing this collection will begin the first of the year. Doctor Brown reports that, aside from the two or more mountable skeletons of the great saurpods which can be assembled from this great mass of material, its chief value is that it represents the reptilian fauna of this region during Upper Jurassic or Lower Cretaceous time and helps to give an insight into conditions of environment.

A Wurttemberg Dinosaur Skeleton

A new dinosaur skeleton is about to be added to the Hall of Dinosaurs in the American Museum. This is the most primitive of all of our dinosaurs. It is known as *Plateosaurus* and comes from the Triassic beds of Wurttemberg, and is, as it happens, the only skeleton in the great Dinosaur Hall to come from outside of North America. *Plateosaurus* was bipedal in locomotion, about twenty feet long, and with teeth on the border line between the true carnivorous and herbivorous types. The mounting has been most skilfully done by Mr. Charles J. Lang.

A Record Proboscidean Tusk

What is probably the record proboscidean tusk will shortly be placed on exhibition in the Age of Man Hall at the American Museum. This is the gigantic right tusk of the imperial mammoth which was discovered, collected, and presented by one of the Museum's life members, Mr. George D. Doughty of Post, Texas. The tusk comes from the vicinity of Mr. Doughty's home in Post, Texas, in which region the imperial mammoth seems to have flourished in Pleistocene times. For many years the department has had on exhibition a skull of the imperial mammoth, also from Texas, with a well preserved pair of tusks, one of which is 13 feet 6 inches in length, measured along the outside of the curve. The new tusk measures 15 feet 4 inches, and has an extreme circumference of 25 inches. Its weight as fresh ivory must have been nearly 300 pounds, and only the greatest of all proboscideans could have carried a pair of such enormous tusks.

Art Studies in the Field

Mr. and Mrs. John C. Germann, artists on the staff of the American Museum, have just completed a 9000-mile motor car trip through the Rocky Mountain region to secure color notes of the principal Tertiary mammal-bearing formations. Twenty-one sketches in oil representing twenty-four formations were made.

These sketches will be used in the preparation of four geologic and faunal charts for the Age of Mammals Hall, showing the various important formations

in their comparative thickness and with scale restorations of the typical fossil mammals found in each horizon.

Instead of the ordinary geologic charts with simple horizontal bands of arbitrary coloring, these new charts will show actual scenes of various important fossil localities superimposed one upon the other and with true coloring.

Trailside Museum Activity

The Bear Mountain Trailside Museums and Nature Trails, operated jointly by the American Museum of Natural History and the Commissioners of the Palisades Interstate Park, now remain open throughout the year. During the winter season, the main Nature Trail has been kept open and has been used by the public continuously. The new Trailside Historical and Indian Museum has also been operated during the winter and, in addition, the Trailside Geology Museum and the Trailside Craft-house have been opened daily.

The Trailside Craft-house has been furnished to house animals that were formerly kept in the Trailside Museum in the center of the Nature Trail area. Since January 1, 1934, more than 390,000 persons have visited the Trailside region.

Thanks to the employment of men through the "T.E.R.A." the "C.C.C." and the "C.W.A.," the entire region has been vastly improved during 1933 and 1934. Four new museum buildings have been erected during this time. In all there are now five Trailside units. The original Trailside Museum was completed in 1927, the Geology Museum and the Craft-house in 1933, and the Historical and Botanical Museums in 1934. The new museums are grouped near the automobile approach, beside the Bear Mountain Bridge toll house, and in no way encroach upon the Nature Trail area.

The new Trailside Botanical Museum has proved a most valuable teaching asset. Here a concentrated, highly important story is told. Living plants, charts, mechanical devices, and a large cut flower exhibit, (324 species shown during the season), held the interest of visitors throughout the summer.

For a number of years there has been a need for an Historical Museum in which to exhibit local, historical, and Indian collections. During the winter and spring, 1934, a beautiful building was designed and built. The structure stands in the center of old Fort Clinton, where an engagement of the American Revolution took place in 1777.

PERKINS DRIVE

Trailside attendance has increased greatly during the current year. One of the principal factors in this connection was the opening of the George W. Perkins Memorial Drive, on October 31, 1934. The number of Trailside visitors increased in direct proportion to the great number of persons who visited the road

during the fall and winter. The new road leads directly to the top of Bear Mountain and is five and one half miles long. It has been completely landscaped. More than 433,530 square feet of sod alone have been laid down. Trees, shrubs, and wild flowers have been transplanted over an area of 86,700 square feet.

The Perkins Memorial Tower, at the summit of Bear Mountain, is sixty feet high. The mountain is 1305 feet high. A magnificent view extends on every hand. The tablet on the tower bears the following inscription:

This Drive and Tower are dedicated by the Commissioners of the Palisades Interstate Park to the memory of

GEORGE WALDRIDGE PERKINS
Their first President, 1900-1920, whose broad vision and tireless energy made possible the preservation of the Palisades and the establishment of this great playground for humanity.
1934

ECOLOGICAL SURVEY

Commencing in the spring and continuing on through the winter, the Trailside Museum secured the services of two "Wild Life Technicians" through the "C.C.C." branch of the Department of the Interior. As there were no definite plans formulated for these men, the Trailside Museum decided to use them to make a wild-life survey of the Bear Mountain-Harriman section of the Palisades Interstate Park.

Under Trailside advice and supervision the men were sent into the field to make daily observations of birds and mammals, to keep daily notes, and eventually to report upon the various regions of the park as to predominant plant and animal life in each section studied. The information gained to date has been of real importance.—W. H. C.

Free Education Tours at the American Museum

Among the new educational broadcasts by the department of education of the American Museum is one on Thursdays at 5 P.M. over WNYC, in addition to the program on Saturdays at 6:30 P.M. over WOR. Responses to both of these at the follow-up tours in the Museum on Saturday afternoons at 3 P.M. average about 100 persons per trip. The programs for January and February over WOR, and for January, February, and March over WNYC, are given herewith.

WOR

Saturday	6:30 P.M.	John R. Saunders
Jan. 5		"Dinosaur Eggs"
12		"A Bird a Day"
19		"A Kayak for Two"
26		"Jade"
Feb. 2		"Penguin Prattle"
9		"Eleven Men of Science"
16		"Survival of the Fittest"
23		"The Sun Dance"

WNYC

Thursday	5:00 P.M.	Robert R. Coles
Jan. 3		"Evolution of the Horse"
10		"Denizens Beneath the Seas"
17		"Upside-down Geography"
24		John R. Saunders

Jan. 31	"Nature, Fact and Fiction"	Robert R. Coles
Feb. 7	"Cave Paintings"	John R. Saunders
14	"Whale Stories"	Robert R. Coles
21	"The Wolf"	John R. Saunders
28	"Pond Dwellers"	Robert R. Coles
Mar. 7	"Drama"	John R. Saunders
14	" Eskimo Life"	Robert R. Coles
21	"Bumboo"	John R. Saunders
28	"Pearls"	Robert R. Coles

Theodore Roosevelt Memorial

The Memorial is now in its fifteenth year, since it had its beginnings within three weeks of the untimely death of Theodore Roosevelt, January 6, 1919. Again we are reminded of the saying:

"Art is long, and time is fleeting "

In every detail the Memorial will be a great work of art as well as a great tribute to the many-sided character of Theodore Roosevelt. The artists who have been especially concerned since the architectural competition of the year 1925 are John Russell Pope and Otto Eggers of the firm of John Russell Pope. The sculptors are James E. Fraser, who is executing the equestrian statue for the east façade and who has completed and set in place the superb figures of the great American explorers and naturalists, Lewis, Clarke, Boone, and Audubon. Also Edward F. Sanford, Jr., has carved the bas reliefs on the balustrade. The great mural paintings of the interior are in the hands of William A. Maekay. At the present time a number of other artists are being engaged, especially for the educational decoration of Floor I, which will be entitled Natural History of New York Hall and which will epitomize the great lives and works of the geologists, palaeontologists, and zoologists who were nurtured and trained in the Empire State and later led the successive geological surveys of our western territories and states. The Trustees are determined that the Natural History of New York shall afford inspiration to all the rising young naturalists and potential explorers of New York State.

The building is now two years behind the contract time and several months will elapse before it can be completed without and within. It may prove possible to keep the costs within the terms of the final Act of the Legislature (Chapter 265, Laws of 1930): "As a tribute to the memory of Theodore Roosevelt there shall be erected . . . an education building, chiefly for the benefit of the youth of the State, which shall hereafter be known as . . . the New York State Roosevelt Memorial."—H. F. O.

Mastodonts and Elephants

One is reminded of the saying, "Rome was not built in a day," by the long period of time it has taken to produce the Proboscidea Memoir which is now in its twenty-seventh year. It really began with the discovery of the ancestors of the Mastodonts embedded in the sands of the ancient River Nile, about sixty miles southwest of Cairo. After the English discoverers had published a memoir describ-

ing these most interesting fossils, President Jesup financed an expedition headed by Professor Osborn and Curator Granger who began big-scale digging in the American Museum method, with the aid of George Olsen and a large force of natives from Kuft, previously experienced in archaeological work. This collection was given to Matsumoto, Japanese palaeontologist, to describe, and it inspired Professor Osborn to take up the story of Proboscidean migration from Egypt to every continent of the world except Australia.

The late Lindsay Morris Sterling began the illustrations which on her lamented death were continued by other artists. Six years ago Margret Flinsch came over from the Frankfurt Museum to undertake the restorations. Meanwhile, with the coöperation of Professor Gregory, Professor Osborn began the intensive study of fossil Mastodonts and Elephants in all the museums of the world, and with the completion of the Titanotheres Monograph in 1920 set to work upon the preparation of the text. The subject grew in interest by leaps and bounds, and has finally resulted in a complete revolution of our knowledge of the Mastodonts and Elephants, of their migrations and habits, and of their almost infinite adaptations to life in all environments from the arctic tundras surrounding the North Pole to the deserts of western America, the mountains of the Andes and the pampas of the Argentine. Next to man the Proboscidean proves to be the most versatile and successful explorer and traveler the world has ever known. Every week adds some discovery of interest. The latest accession to the remarkable American Museum Proboscidean collection is the record tusk of a gigantic imperial mammoth from Texas which will soon be on exhibition in the Hall of the Age of Man.

It is expected that Volume I, the Moeritheres of North Africa, the Deinotheres of Africa and Eurasia, the Mastodonts of the northern and southern hemispheres, will be published before the close of the present year, in order that the new discoveries may bear the date 1934. Volume II, the Stegodonts and the Elephants, will be worked out during the year 1935.

"Meshie"

Meshie Mungut, famous "Child of a Chimpanzee," owned by Mr. Harry C. Raven, associate curator in the department of comparative anatomy of the American Museum, has taken up her residence at the Zoo in Brookfield, Chicago, whither she traveled early in December.

Mr. Raven, who left New York on December 4 for a long trip into the interior of Burma with the Vernay-Hopwood-Chindwin Expedition, was faced with the problem of providing a suitable home for his remarkably intelligent pet, where she could be happy and comfortable, and grow into adulthood with

others of her kind. She now weighs nearly 70 pounds, and is becoming too strong and quick to be trusted as a playmate for Mr. Raven's three children, who have been her companions for several years. Mr. Raven finally accepted the offer of the Chicago Zoological Society to purchase her and establish her in their beautiful zoo at Brookfield.

Meshie was born in February, 1929, in French Cameroun, West Africa, and was bought by Mr. Raven from some native hunters who had killed and eaten her mother. Meshie was then but a few months old.

Many of the adventures and accomplishments of Meshie have been described in the pages of NATURAL HISTORY by Mr. Raven.

Unique Food Plant Exhibit

Among the notable entries at the fall flower show of the Horticultural Society of New York, November 15-18, at the American Museum of Natural History, was the picturesque educational exhibit of the New York Botanical Garden. A gold medal was awarded for the display, which demonstrated the geographic origins of the principal cultivated food plants of the world.

Sugar-palm in Blossom

The sugar-palm whose topmost leaves touch the peak of the ninety-foot dome in the main conservatory at the New York Botanical Garden is finally blossoming this fall. Tassels a yard long, thickly studded with greenish flowers, hang from among the leaves near the top of the tree. Dr. Elmer D. Merrill, director, who has seen many trees of this type in their native habitats, declares that about every month or so a new inflorescence will come out, each from the axil of the next lower leaf, until the lowest leaf is reached. Then the tree will die.

This sugar-palm, which botanists now know as *Arenga pinnata*, after having for years incorrectly called it *Arenga saccharifera*, might be known as the thirty-year tree, because in Malaya, the land of its origin, and in the many Pacific Islands where it has been introduced, it lives about thirty years, then it blossoms and dies.

The natives, however, frequently give it no opportunity to live its full life span, for the tree furnishes many important products for them. From the flower stalks, sap is obtained which is boiled into excellent sugar or fermented into a palatable wine, in the Philippines called tuba. Other parts of the tree furnish a durable thatch for houses, fibers for rope, caulking for boats, and other materials for brooms, baskets, raincoats, and an inferior sort of tapioca. In addition, the nuts, the pulp around which is filled with millions of microscopic needles of oxalate of lime, are cooked and eaten. The tree will remain as a public exhibit in the conservatory as long as it blossoms and lives.

Recent American Museum Publications

NOVITATES

- No. 752. New American Asilidae (Diptera). III. By C. H. CUFER.
- No. 753. Studies of Peruvian Birds. XIV. Notes on the Genera *Dendrocolaptes*, *Hylæzetetes*, *Ziphoelaptes*, *Dendroplex*, and *Lepidocolaptes*. By John T. Zimmer.
- No. 754. A New Species of Antilocaprine, *Tetrameryx Onus-roagris*, from a Pleistocene Cave Deposit in Southern Arizona. By Quentin Roosevelt and J. W. Burden.

- No. 755. Two New Fresh-Water Fishes (Percosomae) from New Guinea. By J. T. Nichols and H. C. Raven.
- No. 756. Studies of Peruvian Birds. XV. Notes on the Genus *Xiphophynchus*. By John T. Zimmer.
- No. 757. Studies of Peruvian Birds. XVI. Notes on the Genera *Glyphorhynchus*, *Sittacomus*, *Deconychura*, *Margarornis*, *Premnornis*, *Premnoplex*, and *Sclerurus*. By John T. Zimmer.

BULLETIN

Volume LXVIII Art. 1.—Mammals Collected by A. W. Anthony in Guatemala, 1924-1928. By George G. Goodwin.

Recently Elected Members of the American Museum

SINCE the last issue of NATURAL HISTORY, the following persons have been elected members of the American Museum:

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Reviews of New Books

Recent Publications For Those Interested in Nature

Confessions of a Scientist. By Raymond L. Ditmars. The MacMillan Company, New York. 1934. 241 pp. Illus.

DOCTOR DITMARS during the years he has been in charge of the collection of reptiles and mammals at the New York Zoological Park has accumulated a wealth of experience not only with these animals but with the public interested in learning more about them. The present volume combines a series of personal, almost confidential, talks about many phases of his work in the field, at the Zoo, in the motion-picture laboratory, and on the lecture platform. The chronicle is of particular interest to New Yorkers who have seen their Zoological Park grow to an institution of such importance in scientific and educational fields.

A lifetime as rich as Doctor Ditmars could not be crowded into one volume, and most of the incidents considered are those of recent occurrence. Doctor Ditmars has captured a vampire bat in a Panamanian cave and has studied it and its young for long periods at the Zoo. He speaks of the pleasures of observation, and the difficulties of making sure that these records are really new to science. Doctor Ditmars has aided investigators in their recent utilization of snake poison in the treatment of cancer and hemorrhage. He describes the pleasure of aiding in real scientific achievement and expresses the hope that snake poisons will find wide application in the relief of human ailments. He tells what goes on behind the scenes at a great Zoological Park, the difficulties of accepting pets, and of securing dignified and yet adequate publicity. The letters of inquiry concerning snakes outnumber all others received in the combined animal departments of the Park, and hence Doctor Ditmar's desk work alone is no small part of his job. From all the recent happenings in Zoo, motion picture studio, and field, he has selected the most interesting and described them in a delightful style. The book will appeal to all lovers of animal life and especially to those who have followed the rise and the development of the New York Zoological Park.—G. K. N.

Half Mile Down. By William Beebe, Sc.D., LL.D., Director of the Department of Tropical Research of the New York Zoological Society. With 123 illustrations and 8 colored plates. Published under the auspices of the New York Zoological Society. 344 pp. Harcourt Brace and Co., New York. 1934.

THERE is nothing new under the sun, but who goes where no one has been has merely to keep his eyes open to be in a position to add to the sum total of human knowledge. He who has penetrated to unusual places or has had unusual experiences, possesses something of general or particular interest. The observations, beliefs, and point of view of such a one mean something, and are of interest even if

you do not share them. So it is that the data of exploration have a certain human freshness frequently lacking in more authoritative data of the stay-at-home investigator. They are as a breath of fresh air in the sometimes musty corridors of scientific thought; and Science and Exploration go very happily hand in hand.

The sea is old, so old; but descents to unprecedented depths beneath its surface have the glamour of all true exploration, of penetrations into a relatively unknown world. When down goes Dr. William Beebe in his bathysphere off Bermuda to a final record depth of well over half a mile, it is as though Science for the first time had lowered a sensitized human photographic plate into the abyss. Now it has been drawn up again, and we who are interested turn to this book, each with a different interest dependent on who we are and our respective philosophies of life. Let none of us forget that it is not just a book.

Such of us as have followed the details of Dr. Beebe's deep sea work with the bathysphere as reported in serial publications of the New York Zoological Society will find here a good deal of material with which we are already familiar. Then there are fascinating chapters concerned with methods and ideas of the earliest divers. We learn of Gustav Kobbe's claim of the world's record for fast walking under water; of various diving bells, of Borelli's invention in 1682 of a quite impractical apparatus, which, however, contained the germ of the idea which has made all modern diving possible,—the removal of confined air and the substitution of fresh. The conception, construction and behavior of the bathysphere and its equipment are gone into with much detail, as well as occupying a considerable place in the narrative of observations in the depths, which to a naturalist are the most interesting and important part of the book.

Finally we have observations in the summer of 1934 from the last and deepest dives, emphasizing what seem to the writer their most important features, and a summary of new light thrown on the environment and lives of deep-sea creatures by his bathysphere descents.

At great depths through the fused glass window of his iron ball, Doctor Beebe has seen clearly enough to describe in considerable detail three or four kinds of fishes which seem to be not merely undescribed species but quite unlike their nearest relatives known to science. It was to be expected that observations

of this sort would be made, in fact the possibility or even probability of such observations was one of the principal *a priori* interests in the descent. He has had illustrations of these new fishes prepared, as accurate as possible, from his memory and notes, and has given to each a technical scientific name, just as though a specimen had been obtained to be filed away for reference in the archives of some museum. Herein there is a departure from the convention that demands that a new form be based on some definite specimen in hand, and in general any such practice of naming observations is to be condemned and the names given, perhaps appropriately, disregarded. In this exceptional circumstance, however, where unobtainable fishes can be observed in some detail, it is certainly of value and fitting to have a name to discuss them by. The purpose of science should in all cases have right of way over its practices, and the right course seems to have been followed.

Doctor Beebe is assuredly less hampered by standard inhibitions than many of his scholarly friends, which frequently leads to his being criticized as well as commended. We think of this when he names his retinal image of a strange fish, when he writes in a manner dramatic rather than meticulous, and most of all when we stand before the iron ball he calls a bathysphere now resting in the American Museum's Hall of Ocean Life. Then only can one properly place in one's mental catalogue of human achievement, that on August 15, 1934, William Beebe and Otis Barton, in quest of an ever-young lady known as Truth (wearing as a veil the ocean), descended in this same iron ball 3028 feet, well over half a mile, into the perpetual black night of the depths of the sea,—and then only can one place this book on its proper shelf.—J. T. N.

Fog. By Alexander McAdie. The Macmillan Co., New York, 1934. 23 pages of text, 52 pages of plates.

THIS well illustrated book by an expert meteorologist commands attention. The brief text states how fog is formed, its nature and characteristics, and reveals some of the methods which have been tried in dispelling it. Most of these methods, however, except in small enclosed spaces, have proved to be too expensive to be undertaken out of doors. The author states that air and fog are separate entities, that the air does not absorb the water-vapor, but carries it along, and that each of the entities has its own temperature, pressure, and density. He cites instances where fog has been very detrimental to the activities of great cities such as New York, London, and Berlin, also where it has influenced the course of history and where it has impeded even the daily routine of an entire nation. He states that we are safe in giving an estimate of twenty days each year when traffic in large cities is seriously impeded, if not suspended, by fog, with resulting high financial loss and notable injuries to

human beings. He calls attention to the two kinds of fog that cause most trouble, namely: ground fog produced by radiation from the earth, and advective fog, the kind that is carried from place to place such as sea fogs.

He states that much has been accomplished in connection with aviation in developing instruments which permit aviators to fly safely through fogs. He is of the opinion that continued study and experimentation may eventually produce methods whereby fog may be dissipated locally and thus facilitate shipping, aviation, and ground traffic in and near large cities.

The illustrations, which have been reproduced with notable artistic success, are excellent; the text matter, however, is in general most too technical for a ready understanding by lay readers

—CHESTER A. REEDS.

The American Eagle. A Study in Natural and Civil History. By Francis Hobart Herrick. D. Appleton-Century Company. New York. London. October 26, 1931. 8 vo.

PROFESSOR HERRICK made his name familiar to students of American birds in 1901 when he published his notable *Home Life of Wild Birds* with its excellent photographs of the nesting activities of many familiar species. These photographs had been taken from an observation blind set up in close proximity to the nests. On occasion, when conditions were unsuitable for photography, the nests had been moved, with proper precautions, to more effective places, without disruption of the daily activities of the birds.

An apparent impasse was reached in the case of the American eagle,—that is to say, the bald eagle or, as the author philologically insists, the bald-headed eagle. The bulky nests of this species, placed at considerable heights in somewhat isolated trees, are all but inaccessible to the photographer and most certainly cannot be moved at will to more convenient situations. At an early date, therefore, in 1899, Professor Herrick conceived the idea of building a tower near an eyrie and placing his observation blind upon it, but many years were to elapse before the idea blossomed into use.

In 1922 the first experiments were made to determine the eagles' reaction to an alien structure erected near their nests. An elevated platform was built in a convenient tree and, with some additions to its height, was used for several years, until the nest was destroyed by a storm. As this experiment proved quite successful, a steel tower was erected in 1926 at a chosen site near another nest, later to be moved as circumstances directed. The following years saw many vicissitudes. Storms destroyed one eyrie and uprooted the tower; one set of eggs failed to hatch; a falling tree nearly caused disaster. Nevertheless, the work continued for seven seasons, to be terminated at last in June, 1930.

As may be imagined, trained observers like Profes-

sor Herrick and his assistants, sitting, day after day, unseen within (sometimes) a dozen yards of a family of these great birds, were able to make exceedingly careful observations on the minute-by-minute life going on before their eyes. Current reports of these observations were published from time to time in the pages of *The Auk* (1924, 1932, and 1933), and these have been collected and rewritten to make a complete record of the consecutive seasons of field work and additional experiments in the laboratory.

All the phases of an eagle's life at the eyrie during daylight hours are here set down, from the early infancy of the chicks (the actual hatching of the eggs was studied in the laboratory) to their final departure from the nest. The reactions of adults and young to their environment and to each other, their food and feeding habits, their vocal efforts, their play,—all are faithfully recorded.

One could wish that there were more information about the life of the birds away from the nest—their mating habits, their methods of capturing their prey, their activities during the winter, and similar topics which are very lightly touched, if at all mentioned. These facts, of course, are not to be learned from a single fixed post near the eyrie, occupied only while the young are in the nest, and within these implied, if not expressed, limits the given facts are relatively complete.

An attempt is made to group the subject matter under various chapter headings, but the result is not entirely satisfactory, and topics may be found discussed at several places in the volume with resulting confusion to the reader. This may, perhaps, be partly unavoidable because of the intimate interrelationships of the various activities of life in the nest and because the account deals with several families of eagles observed in different years. A good index, however, serves to bring the scattered observations together in accessible form.

Although the original studies deal entirely with the bald eagle, many supplementary notes are given regarding other species. The book concludes with a discussion of eagles as they appear in heraldry, in apotheosis, and in numismatics, with especial attention to their appearance on the emblems and coins of the United States. The pages are enlivened by a selection from the many excellent photographs taken from the observation blind and from other vantage points, and by illustrations of coins and heraldic devices showing this group of birds.

The work is one of the most complete studies of its kind that have appeared and forms a monument to

the ability, patience, and untiring zeal of the author applied to a difficult task.—J. T. Z.

Wild Flowers. By Homer D. House. New York: The Macmillan Co. 1934. 364 full-color illustrations with complete descriptive text.

THIS is a gorgeous book of the wild flowers of eastern North America. Although by no means complete, it contains nearly 400 of our most conspicuous wild flowers. Each plant is represented by a beautiful, large, colored plate, made from a natural-color photograph or autochrome. In fact, these plates were originally made for the superb and deservedly popular set of two large volumes on the *Wild Flowers of New York*, under the supervision of the State Botanist, Dr. Homer D. House.

With the permission of the Board of Regents of the State of New York, Doctor House has used all of these colored plates, together with many excellent black and white photographs, in this new work of one volume. The text descriptions are non-technical and brief. Both common and scientific names are given, and the range of the plant. In short, we have here a book "with many pictures and little reading," which was not prepared for the technical botanist, but for the layman who would like to name the flowers without a key, but by the aid of pictures.

The book is a thing of beauty. An examination of the exquisite plates in faithful natural colors will recall many delightful associations on the part of all lovers of the outdoors. It is a book to own and to enjoy. We predict a wider popularity than that of its predecessor, *The Wild Flowers of New York*.

—CLYDE FISHER.

Talking Leaves. By Julius King. Cleveland, Ohio. Harter Publishing Co. 1934.

HERE is an attractive and useful little book which describes more than fifty of our most common trees, one page being devoted to each kind. There is just a brief paragraph of text about each tree, the most important part of the treatment being the illustrations of which there are three. First there is a drawing of the tree as a whole showing the general habit of the species, but these are too small to be very helpful. The approximate height of each tree is printed below each of these drawings. The drawings of the leaves, flowers and fruits, on a scale large enough to occupy about half of each page, are by far the more valuable aids in identification. The third illustration is a map of the United States, showing the range of the tree in green shading, thus constituting an important feature of the little book.

—CLYDE FISHER.

NATURAL HISTORY

The Journal of the American Museum of Natural History

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Subscriptions should be addressed to 10 Ferry Street, Concord, N. H., or to The Treasurer, The American Museum of Natural History, 77th Street and Central Park West, New York, N. Y. NATURAL HISTORY is sent to all members of the American Museum as one of the privileges of membership, \$2.10 of the annual amount received from each membership being in payment of the year's subscription to the magazine. GEORGE L. ALPERS, Advertising Manager, Advertising Office, The American Museum of Natural History, 77th Street and Central Park West, New York, N. Y. Copyright, 1935, by The American Museum of Natural History, New York



Daughters of the Rif

These two girls are from the Rif fishing village of Tiguissas of the Ghomara, the scene of a famous battle between the Riffian army and the Spanish invaders. They were very shy, and Mrs. Coon, who took the picture, was forced to spend several days and make gifts of dozens of safety pins before they would consent to pose

(See "The People of the Rif")

NATURAL HISTORY

February, 1935

The People of the Rif

After having bravely maintained their independence for scores of generations, the white tribes of the mountains of North Africa have, within the last few years, been forced to take their place among the subject peoples of the world. It is not impossible, however, that they may still come to play a more important part in the world than they have ever played before

By CARLETON S. COON

Department of Anthropology, Harvard University

AS IS the case with many other brave and spectacular groups of people, much rubbish has been spoken and written about the Riffians. They are often pictured by drug-store novelists and by scenario-writers as lean, hawk-beaked men, shrouded in flowing robes, and riding over the desert on brightly caparisoned horses, leaning down out of the saddle now and then to snatch up whatever ravishing female it may suit the convenience of the narrative to have violated.

As a matter of fact most Riffians are not lean, but broad-shouldered and well filled out; their noses tend no more to aquilineity than do those of most Europeans; few of them own horses, and fewer still know how to ride; and, as a rule, they are not interested in the capture of European females, most of whom would probably not appeal to them.

What makes the Riffians especially interesting to science is the fact that so many of them are blond; what makes them interesting to the world at large is that they, a primitive people, situated on one of the world's busiest traffic corners, were able to preserve their independence and keep their rocky soil inviolate until those heart-breaking days of 1926, following Abd el Krim's surrender. How they kept their country as

inviolate as Tibet, requires a description of their familiar landscapes and of their culture.

Some of the readers of this article who may have steamed past the northern shore of Morocco may have been reminded of the line in that melancholy Irish ballad: "Where the mountains of Mourne sweep down to the sea." That is just what the Riffian mountains do. From more than one windy pass in the Rif, one can look straight across the Mediterranean to the southern Spanish Sierras. These mountains are not high, for they rise directly from sea level, but they are, nevertheless, rugged and impressive, and form an effective geographical barrier. In only one spot do they harbor a patch of permanent snow, but the abodes of several of the smaller tribes are as snowy in winter as is New England. High up on the slopes stand, or perhaps rather stood, dense forests of cedar, while down in the valleys the torrential streams are lined with trees which bear quantities of olives, almonds, walnuts, figs, apricots, pomegranates, oranges, lemons, mulberries, apples, and edible acorns, to mention the more common fruits. Patches of cork forest provide the western tribes with light and waterproof material for roofing. The Riffians are excellent carpenters, where they can get enough wood, and some of their houses, especially in the west, are well made and artistic.

In the old days the Rif was the home of heavy-maned lions, the last of which prob-



An old man of the Beni Bu Frah, one of the coastal tribes of the Rif, leading his mule to market. This picture shows the typical shwari, a twilled double panier, which can be slung over the hallas, or stuffed packsaddle, in a moment. The Rifians are among the world's most scientific mule packers

This mokhazni in the Spanish service, a former soldier of Abd el Krim, is a member of the Beni Znassen, a tribe of Berber nomads who inhabit the semi-desert on the south-eastern Riflian border



Mountain Dwellers



Two Rifian boys of the Beni Urriaghel tribe. The larger one is wearing the typical Rifian jellaba, a short cloak with sleeves and a hood



A young married woman of Taghzuth, wearing the thaw-that, the old-fashioned women's garment of the Rif

A blacksmith working at his temporary anvil outside the market at Ajdir, Beni Urriaghel. In the Rif all blacksmiths are persons of negroid blood, and are not allowed to marry outside their own group



ably died within the past century. Wild oxen, it is said, still survive on the gravelly plain which forms the southeastern border of the Rif. The aoudad once climbed about the peaks, and a very few may possibly survive. The only big game left there today in any numbers is the wild boar, which troops the hills in search of acorns and of gardens to plunder. Although they profess Islam, many Riffians are not averse to dried boar's flesh, and the writer recalls with pleasure the gamy taste of wild ham fed him in some of the higher villages. Hyenas, foxes, and jackals of two varieties are not uncommon, as well as hares, rabbits, weasels, and at least one species of mongoose, and a few varieties of wildcat. Monkeys, which scramble over the rocks just south of the Straits of Gibraltar, do not live in the Rif.

Travel by horse was, before 1926, very difficult; most people did their journeying by foot, while donkeys and mules were used more for burden carrying than for riding. Camels are driven into only the eastern Riffian tribes, where the mountains are lower and slope off gradually into a barren waste, inhabited by nomads, only some of whom are Riffian in language. It is these border tribes, largely atypical, with whom the French had their first fracas, and who consequently are responsible for much of the popular misinformation about Riffians.

THE CAUSES OF THEIR ISOLATION

Although the environment in which the Riffians live is rugged and forbidding, it alone has not produced Riffian isolation. The character of the Riffians and their manner of living are equally, if not more fully, responsible. The Riffians are essentially warlike and essentially xenophobic. To them freedom is the most important thing in life, and their concept of freedom involves not only the non-interference of foreign authority but also freedom of tribe from tribe, of village from village, and of individual from individual. It is difficult to generalize about Riffians, for each man is a separate entity with his own peculiarities of character and his own ideas. In his type of government this emphasis on individualism is apparent.

The unit of social organization is an ex-

panded family group called the "Vein," including a number of brothers with their wives, sons, sons' families, and unmarried daughters, granddaughters, and so on. This vein occupies one house or neighboring houses, and marriage between its members is forbidden. If one member of a vein is killed, it is the duty of all other members to avenge him, and if one of them commits murder, all others are equally liable to death in revenge. These are not theoretical rules, for in most veins reciprocal murder has taken place at least once in a generation.

Beyond the vein is the "Bone," a clan-like grouping which contains vein relatives who have been relieved of their incest relationship by the death of the oldest generation which bound them together. Thus all members of a bone, saving those taken in by adoption, are relatives, and marriage usually takes place between bone members. Hence a form of distant cousin marriage is usual, or first-cousin marriage where the relationship is only on the female side. This system naturally tends to preserve and accentuate individual family characteristics.

THE ORGANIZATION OF THE CLAN

Beyond the bone is a grouping which may be translated as "Canton," and which consists of some geographical unit, usually a valley, in which several bones have their residence. This canton is rather loosely governed by a council, constituted, by family appointment, of prominent men from each of the bones in the valley. This council meets whenever a breach of the peace occurs, which is rather frequently, and has charge of all offenses short of murder.

In case of murder the councils of the whole tribe, including all its cantons, convene; the spokesmen of the various councils meet in the center of some flat place, while their members form a circle about them. Here the spokesmen deliberate, and determine, after much arguing, both the amount of the fine to be exacted, and the amount of blood money to be paid to the relatives of the deceased. The blood money is intended to assuage the grief of those bereft, and act as a deterrent to reciprocal murder, but it often fails to fulfill this purpose. Many

families refuse to accept it, preferring to exact revenge by Mosaic retaliation, in which case there will be no punishment; others accept the money and regret it later, consummating their revenge and paying a fine and blood money in turn. Although the blood money goes to the relatives, the fine, which is usually the larger of the two amounts and often runs into several thousands of Spanish dollars, is divided among the spokesmen who in turn divide it among the council members, who in this manner receive payment for their services.

THE RESULTS OF DISAGREEMENT

It often happens that members of the council cannot come to an agreement; some may be friends of the murderer, others of the victim. Hot arguments ensue, and fighting, and the council splits into two hostile groups entrenched opposite one another. Reinforcements take place on both sides, and soon the tribe is without government. This is the occasion for other tribes to profit. Several of them may meet in one spot and from there invade the territory of those preoccupied by internal battle; the invaders capture village after village, for all are half deserted; they exact fines of increasing size from each village subdued, and take the men of each along with them as forced allies. These allies often are easily persuaded, for they share equally with the others in the fines thenceforth collected. Thus the tribe taken unawares often ceases its internal warring as soon as possible, to patch up a truce and unite against the invaders — but the latter have the advantage of surprise and are difficult to defeat. Thus the lofty purpose of the invaders, to enforce peace, is accomplished by much bloodshed and loss of property; with this background of local custom it is not surprising that the Riffians easily understand the finer principles of France's "peaceful penetration," of Lyauty's prostrate peace.

One need not go far to discover the reason for this overdevelopment of internal homicide among the Riffians. The Rif is a small country and chronically holds more persons than its soil can comfortably support. Agriculture has been pushed up the narrow valleys into terraces sometimes no more

than a few feet in width; irrigation water must be led for miles through rock-carved ditches, and across canyons in wooden troughs; in the springtime when the barley and rye have been eaten, whole families subsist for months on dried apricots and raisins, while the women comb the mountain-sides for green shoots, especially wild asparagus, and reach into the icy pools along the streams for watercress.

A man who feels himself important may usurp a terrace belonging to a neighbor, or may take more than his share of water from a ditch. There is always tension over land ownership and water rights, and with no effective central government, reciprocal murder springs up without difficulty. On top of this the Riffians have a very keen but boisterous sense of humor; they are forever playing jokes on one another, many of which are as cruel as they are funny, and some of which have been known to cause feuds.

Like many other peoples, the Riffians have a code of sexual morality which is so strict that they cannot all live up to it, hence seduction and illegitimacy give rise at times to blood-letting, while adultery traditionally leads to the murdering and mutilation of the male offender, and nose-snipping and ejection of the faithless wife, both by the betrayed husband. Thus, although the feuds which arise over women are in the minority, they are nevertheless a factor to be considered.

MARRIAGE AND PARENTHOOD

The Riffians as a rule marry young, when the boys are anywhere from fifteen to eighteen, and when the girls are about fifteen. They begin producing children as soon as they are able, and continue doing so as frequently as possible, for an early death lurks ever ahead of the father of the new family, and it is well, from their standpoint, to have sons before the father is killed. A youth of twenty slain in a family quarrel may leave three or four children, and these, as well as their mother, are taken over by one of his brothers, in accordance with the ancient institution of the levirate. Hence, in the central tribes, where mountains are highest and terraces are narrowest, polygyny is the



A view of the main square in Sheshaven. The octagonal minaret has no duplicate in Morocco. The broken roof in the right foreground is the work of the American aviators in the French-Maroccan service, who volunteered to bomb the Rifians. On their account the name "American" was not popular in Sheshaven



(Above) A street in Sheshaven. This city, in the center of the Jebala country which lies to the west of the Rif, was Abd el Krim's western headquarters

(Right) In the eastern Rif the houses have flat roofs and are surrounded by walls topped with thorny hedges. This Beni Said house is a good example of the adaptation of house type to climate

Architecture in the Rif





(Above) The main mosque of Ulad el Wartith, in the valley of Taghzuth, with the schoolhouse at the right

(Left) A house of the Beni Bu Nsar, whose name means "The Children of the Christians." These people have a tradition that their ancestors were Christians exiled by some ancient king. They eat pork, indulge in intoxicating grape jelly, and retain many early Christian traditions. They are said to hold Christian ceremonies in great secrecy



rule, and it is not a gustatory polygyny, as among the Arabs, but an economic and social polygyny where every boy needs a father and every woman a husband.

Although few Riffians amass really great wealth, none of them need starve unless all are starving, since several communal institutions provide for all. A man who owns more land than he is able or willing to till may call in poorer neighbors who will work with or for him, and who will receive a generous portion of the produce, allotted by set rule. A man who has been lazy and whose family is in want in the springtime will be forced to sell some of his terraces for food. One out of three cups of oil pressed in the communal oil machinery goes to the mosque, and one to the poor. Products of the land and trees which belong to the mosque go partly to the poor in land who work upon them, and all the windfall fruit, no matter who owns the trees, belongs to the poor. By diligent work a man who has started life with little may die with much, and the indigent son of a rich father may end in poverty. But if a man acquires property, he must also be strong enough to defend it and wise enough to make good alliances and friends, or his work will go for nothing.

TREATMENT OF TROUBLE MAKERS

Riffians who are habitual trouble makers, who have been in scrape after scrape, and whose families are not powerful enough to postpone indefinitely the wrath of the tribe, are exiled from the Rif. Sometimes whole families, whole bones or villages, are forced to migrate. Small colonies of these exiles are to be found in many parts of Arab Morocco and even in Algeria. These expatriate Riffians have little difficulty earning a living, for they are the best farmers, and especially the best fruit growers, in Morocco. Some of them have made attempts, usually unsuccessful, to fight their way back to their ancestral terraces; others have gradually lost their identities in the surrounding Arabized population.

The blondism of this people, although often exaggerated, is nevertheless real. If one rolls back their sleeves and looks at the skin which the hot sun of North Africa has

not reached, one finds the same pinkish white color, in a majority of instances, which is so familiar in Northern Europe. Even the exposed parts frequently refuse to tan, but burn instead to a chronically raw brick-red. One fourth of the Riffians have freckles, of the type familiarly found in Northern Europe, especially in the British Isles.

COLORATION AMONG THE RIFFIANS

Their head hair is not as frequently blond as people who have seen them imagine, for the reason that the hair usually seen is that of the beard, and the beards of the Riffians are as a rule lighter than the hair on their heads. Less than half have black head hair, but the majority fall into the classes most frequently seen among Americans — dark brown and medium brown. About one Riffian in four has a beard which the average observer would call blond. Only one beard out of three could be called black. The remainder, slightly less than half, fall into the intermediate classes, with strong reddish tinges frequent.

Riffian hair, when blond, is of the golden type; it is never of the dull, ashen hue so frequently encountered among Poles and Finns. Riffian blondism is of the same type as that found in the British Isles, not of that in the eastern Baltic countries. The presence of four per cent of reddish tints in hair color, and seventeen per cent in the beards, marks the Riffians as one of the reddest-haired peoples in the world, just as they are one of the most freckled.

Well over half of the Riffians have eyes which look blue, gray, or green; but which, most frequently, show brownish spots on a lighter background. The combination of bluish eyes under beetling eyebrows, with a blondish or red beard and a ruddy white skin, seen in a large minority of Riffians, is indeed sufficient to give the untrained observer the impression of a pure blond race. As a matter of fact, if observers in all countries used the same standards in observing hair and eye color, it would be seen that few countries outside of the British Isles, Scandinavia, and the nations bordering the Baltic were blonder than the Riffians.

It is apparent from this rapid survey of

(Below) These Taghzuthi leather workers are embroidering cartridge belts with thin strips of leather, in many colors. Their work is very fine and extremely decorative, and these belts were highly prized by Abd el Krim's soldiers. Some of the cheaper work of these men, in the form of handbags, has found its way to American gift shops and department stores



(Above) In the Vale of Therrushen, in the northern part of the tribe of Gzenaya, a farmer is making a large basket in which to store his winter's supply of raisins. This region is one of the few parts of the Rif which fall under French administration

(Below) This olive grinding machine of Taghzuth is typical of the whole Rif. One is found in every village, and the heavy stone is turned sometimes by men and sometimes by mule power. The crushed olive pulp is then gathered in baskets and squeezed in a heavy screw press. Each man must take his turn at this grinder, and the schoolmaster keeps a record of the order in which the different farmers may use it



Riffian blondism that these mountaineers are, like most other white people, mixed in race; and in their mixture the Nordic strain plays an important part. If one compares the measurements of head, face, and bodily dimensions of the Riffians who are not brunet with European peoples, one finds that the greatest similarity exists between them and the natives of some of the most isolated mountain valleys of Eastern Norway. There is no question but that one element among the Riffians is Nordic. The great question, however, is how the Nordic race got to Morocco.

THEIR UNKNOWN ORIGIN

A survey of the eighteen tribes of the Rif and of their near neighbors shows that the greatest blondism and the greatest frequency of Nordic physical type occur in the very center of the Rif where the mountains are most inaccessible and where the culture of the people preserves its most ancient pattern — the conservative nucleus of the country. This region is off the path of the various invasions, Berber and Arab, which penetrated the Rif in protohistoric and historic times.

The Riffians are not the only blonds in North Africa, although they are at present the most numerous ones. The Guanches of the Canary Islands were frequently blond at the time of their conquest by the Spaniards; and a considerable amount of blondism occurs among the Kabyles and Shawia in Algeria. Throughout North Africa, among Arabs and Berbers alike, as throughout Southern Europe and Arabia for that matter, a minimum of blondism pervades all regions yet studied. It is impossible alike to find a blond people of European type who harbor no brunets in their midst, and a brunet people with no individuals showing traces of blondism.

The earliest references to North African blondism come from ancient Egypt. We know that the Mashausha, a blond race, invaded Egypt from the west during the eighteenth dynasty, and their name, as well as their costume, shows them to have been North Africans. The mother of the great Cheops, fourteen dynasties earlier, was pictured in her tomb paintings as a blond, but

there is no proof that she came from the west. There is no definite evidence of the presence of large groups of Nordics in Northwestern Europe before the Iron Age, which began, in those parts, at least a millennium after the well pigmented portraits of the Mashausha had been painted.

For these reasons there is no need to suppose that the Nordic strain in the Rif must be the result of some early though unrecorded thrust from Scandinavia, or that history must be twisted to make the Rif the refuge spot of the defeated remnants of the emasculated Vandals. Both the Riffians and the Scandinavians are partly Nordic; both probably derive their somatic similarities from a single source. Where that source was, and how long ago the ancestors of the Riffians split off from it, are questions which the writer, with his feeble science, cannot answer.

THE DIFFICULTIES OF SUBJUGATION

It is not surprising, in a country where only unarmed holy men may travel from tribe to tribe without fear of assassination, that Moslems from outside, not to mention Christians, have been unable to effect a penetration, except with modern military equipment and the expenditure of many years of effort and much loss of money and of men. The natural increase of the Riffians was cut off by their own system of internal warfare; the losses which they suffered at the hands of France and Spain were little greater than what they would have incurred in the same length of time by natural means.

Spain's desire to rule the Rif was the result of a threefold tradition — to get back at the Moors for the centuries of infidel occupation in Spain, to make up for her loss of colonies elsewhere, and to exploit the fabulous and apparently imaginary mines of the Rif. France's desire to subdue the Riffians was chiefly to eliminate a constant source of trouble on the northern periphery of her zone of influence in Morocco.

Subjugating Moroccan Berbers has not been an easy task for either France or Spain, and not altogether a profitable one. Spain alone was unable to defeat the Riffians. The massacre of General Sylvestre's force



Ploughing with oxen under the fig trees at Ajdir. The ploughman is one of the half dozen negro slaves who lived in the entire Rif before the rise of Abd el Krim



A woman of Beni Said carrying home a load of straw on her back. In the Rif most of the agricultural work is done by the men; the women help only during the harvest



In Taghzuth bread is baked in beehive-shaped ovens. On top of this one there is a sheet of cork, used for many purposes, and a typical carrying basket. The little girl, who is the daughter of the chief of the gunsmiths in this mountain valley, is bringing a walnut branch with which her brothers will fan away flies from her father's guests



*Two men of the Gzennaya
tribe talking it over in the
Thursday Market of
Ikaroen*

Market

*In one corner of the mar-
ket at Ajdir, women sit
with their fresh loaves of
bread. Immediately after
this picture had been
taken, the old woman in
the center pelted the pho-
tographer with stones, and
showed surprising ac-
curacy*



*A jeweller in his earthen
booth at the Thursday
Market of Targuist.
Around each market there
is a circle of such booths
in which tradesmen dis-
play their wares*



Scenes

*Two small girls riding
their donkey home from
the market, along the
shore at Ajdir, Beni
Urriaghel*



at Anual, and the Riffian drive eastward to the sea which followed it, ridded Riffian territory, for a time, of Spanish interference. For the first time the world realized that here in Northern Morocco was a body of men which, though deficient in our concept of civilization, was worthy of military notice. The sultans of Morocco had been unable to exact tribute from them, and the Spaniards could do no better.

What the world failed to realize was the profound transformation that was going on in Riffian mentality. For the first time in history, village was uniting with village, tribe with tribe, until a finite power had been created. This transformation was due partly to the situation, in which for the first time in history such a unity was needed — but it was due in even larger part to the personal genius of one man, Mohammed ben Abd el Krim.

ORGANIZED RESISTANCE

The first organized resistance to the Spanish was developed under the personality of an older leader, the Hajj Bukkeish, who united the northern Gzennaya, the Beni Amart, and the Beni Tuzin, and who was an equal commander with Abd el Krim on the historic drive from Meidhar to the sea. But Bukkeish was an old man, purely Riffian in training and knowledge, while Abd el Krim had been a judge in Melilla and had studied in Spain. Of the two it was the younger man who gained the ascendancy, who imposed his own ideas of organization, and who inspired, for the moment, the unquestioning loyalty and even reverence of these hard-bitten feud-sniping mountaineers, men who had never before heeded the authority of anything more dis-

tant than their own family councils. The Riffians ceased to think of themselves as individuals, and adopted a nationality.

THE FUTURE OF THE RIF

Although the Rif as a nation was short lived, the seed of nationality once sown will take more than a decade of submission to keep it from sprouting. Spain, since her revolution, has begun to realize the potential worth of these men, now that her dreams of mineral wealth have been dissipated; the cruelty with which some of the Riffians were treated at their first yielding has largely given way to a considerate attitude, the employment of many of Abd el Krim's soldiers in the Spanish forces, and a far-sighted leniency in taxation.

The world is full of small remnants of brave and worth-while peoples who have been ground into oblivion by the drab conquest of modern civilization. The Sioux Indians, to quote a single and well-known example, put up a fight equal in quality to that of the Riffians; but the Sioux lived on the buffalo, and when the white men killed off the buffalo, the Sioux's basis of life vanished — nothing remained but starvation or reservations. The Riffians, on the other hand, are farmers, and good farmers at that. They are white men and can take over white men's ways without too much anguish. They are naturally prolific, and their own solution of the increase problem is no longer feasible. If the future does not contain for them the fulfillment of their dreams of separate nationality — and Abd el Krim is alive and still young — they will at least make a worthy addition to the human material of whatever nation absorbs them.

Winter in Yellowstone

Though visited by thousands of tourists every summer, Yellowstone Park is left almost entirely to the animals and the Ranger during the long, cold months of winter

WINTER does not ordinarily descend upon Yellowstone Park without warning, but threatens with a light snowfall as early as the end of August. Between the first flurries and the real winter storms there are generally several weeks of idyllic Indian summer, with falling colored leaves, warm days, and frosty nights.

The calm and quiet of summer turns into activity, activity everywhere. The tranquil forests become alive with noises. Cones drop as pine squirrels begin their harvesting, chattering displeasure at any intruder who interrupts their work; trees crash in aspen groves where beaver are harvesting for winter food; leaves crackle under active hoofs; saplings break with the strain of rubbing antlers; and the bony clanking of fighting bulls is a sign that the elk are gathering their harems. From the timber by day and from everywhere by night comes a lovesong so birdlike that one can scarcely realize it is a combined love call and challenge of the bull elk.

As winter descends, the geysers are nearly lost in a landscape of white, and the summer beauty of the Grand Canyon is obscured under snow and ice. The white peaks and black forests dominate the scenery as wildlife takes the center of interest.

Strange it is that the greatest wildlife sanctuary in the United States today is so ill-suited in winter for some species. Even the mildest winters are periods of suffering and hunger, and when a very cold one arrives, it descends with such grim cruelty that many of the wild animals are unable to survive.

That the Park area was a last resort for most of the animals now living there is indicated in abundant records left by men who explored the region. Prior to 1880, explorers, naturalists, surveying and hunt-

BY WENDELL AND LUCIE CHAPMAN

Photographs copyrighted by Wendell Chapman

ing parties remarked on the absence of game during even the summer season. Although a limited number of mule deer, wapiti, pronghorn, and moose were reported, a characteristic observation by those going through the region later to become the Park, was that they ran short of provisions due to lack of game. Lewis and Clark in 1804-06 recorded that the abundant game of the prairies practically ceased as they entered a similar mountainous country near the present site of Great Falls, Montana.

But after 1880, those going through the Park remarked on the presence of game. The early Eighties marked the last stand of the animals on the plains. With the encroachment of the settler who fenced off the natural feeding grounds, the stockman whose herds cropped off the range, and the rifleman who finished what starvation did not, the safest place for the wildlife to go was to Yellowstone Park, with its climatically inhospitable winters. About this time bison disappeared from the plains and some appeared in the Park. A few individuals of most species of the West managed somehow to find and recognize this sanctuary, and most of those species have been able to survive. Some are naturally fitted to withstand the severe winters, some have adapted themselves well to their adopted land, others are hanging in the balance, while a few have disappeared from the district. Naturally the Park affords drama during the cold winters and deep snows.

The lowest valleys in the Park are a mile or more above the level of the sea, and the grazing or browsing areas within these constitute a very small fraction of the entire Park area. When the deer, wapiti, prong-



Winter



The museum in Morris Geyser Basin. The mounds in the foreground are trees bent over by the accumulation of powdery snow that congeals from the geyser spray carried by the wind



Most shelter cabins in Yellowstone Park are located off the trails and are hard to find in the dark or during the occasional blizzards. The doors of these cabins are never locked during the winter, and they are kept well provisioned

The large photograph above is of the Mammoth Hot Springs Terraces after the first snowfall of early winter. Later in the season they become covered by a solid mass of white, save for a few hot-spring drainage areas

Reigns

Skiing over the Mammoth Hot Springs Terraces is a favorite winter sport in Yellowstone Park. The limestone formations are visible where the hot waters trickle even during the coldest weather



horn, bighorn sheep, and bison are forced down by the snows from the abundant summer ranges of the high plateaus and slopes, they concentrate on the inadequate lower valleys and soon crop off the feed. During even the mildest winters, the uplands are covered with snow and the animals must descend.

Elk form the greatest numbers on the winter range, there being some 15,000 in the Park, while 3000 is considered a more proper limit. Because of the inadequate winter range they are fed hay in case their natural range becomes exhausted or locked under crusted snow. Hunger forces them, against the dictates of their natures, to come on to the fields of the two elk ranches while the hay is being scattered, but they do not become tame. Once feeding starts, they hang around in near-by timber to await the daily dole, and they will well-nigh starve before getting out and rustling again until spring. Because of this tendency to lie down and let the government provide once it starts, the authorities hope to be able to replace the feeding of hay by planting forage crops which will give a yield superior to the native grasses.

MOOSE

One large animal which does not come down to the lower winter ranges is the moose. His long legs are well adapted to taking him through deep snow. Ranger F. Sheldon Dart reported having seen moose traveling quite easily through fifty-four inches of snow in the Upper Yellowstone Valley. The principal winter diet of the moose being willows and shrubs, he is not confronted with the problem of digging them out, because they grow to a height of ten feet or more in his valleys. Unless a thaw causes a hard crust to form on deep snow in the spring, the moose has little to fear from enemies. Harry Trischman, who has seen more of Yellowstone Park than anyone else now in its service, reported having seen a grizzly late one spring overtake a moose. The deep snow was heavily crusted so that the bear did not break through, while the moose did. Under such a handicap the moose was soon caught and killed. Such cases, of course, are rare.

From October until spring, the moose has an ugly disposition and several rangers on patrol have been charged. There are many stories of moose having forced rangers with skis or snowshoes on to climb trees, but investigation invariably reveals in each case that although the moose did make the ranger climb a tree, and kept him up in the cold for a couple of hours, the footgear was first removed.

The most spectacular animals formerly of the Great Plains, the bison or American buffalo, drift down into the Lamar Valley from the summer range on Mirror Plateau, over a mile and a half above sea level. Cowboys then drive them into the corrals at the Buffalo Ranch, where good specimens are selected for shipment to establish other herds, weaklings are butchered for the Indians, and the remainder are released into the valley, where they remain during the winter, daily following the hay-sled. Although the largest of our native animals seem tame while being fed, they always retain the instincts of the wild beast. Occasionally a fence around a haystack is broken down and buffalo enter. Elk who graze compatibly on the open range within a few yards of the buffalo come through the fence to crowd in at the stack. A buffalo, often without warning, impales an elk before it can get out of reach. Whenever a stack is so entered during the night, several elk are found gored. Horses also have been killed in past years before the authorities learned it was not wise to allow them to occupy the same fields with the buffalo. And the buffalo does not draw the line at elk and horses.

An illustration of what he may do to man occurred several years ago when Bob LaCombe was Keeper of the Ranch. An old bull, outcast from the herd, came to feed near the barn during the winter. Daily he ate the hay which was thrown to him, becoming apparently tame. One day Mr. LaCombe went to the barn, passing within a few feet of the bull, who continued eating. A few moments later one of the young assistants followed Mr. LaCombe into the yard, and was about to pass, when up went the bull's tail, steam shot from his nostrils, and on he came, charging like a demon.

Black Bear



Ready for Hibernation

Fat and ready for hibernation, this fine black bear is about to disappear for the winter. It is now a well-established fact that even in the midst of his hibernation period he can be awakened easily and often stands ready to protect himself against attack

Animals of

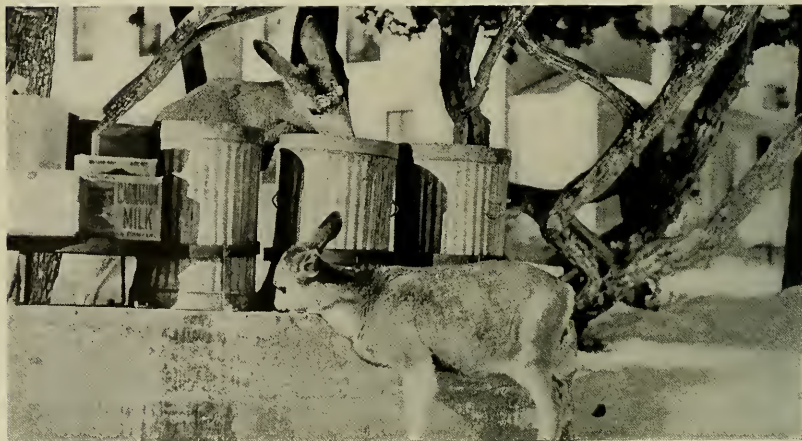


(Left) As winter comes, the mule deer follow the trend and migrate to the lower and less exposed levels

(Right) Extremes of weather often force the elk (wapiti) to respond to the call of hunger and come on to the ranches, where hay is thrown out for them



(Below) Mule deer about Headquarters at Mammoth Hot Springs have become expert at knocking off the lids of the garbage cans in their hunt for food



the
Park



*(Above) When the early
snows cover the higher pla-
teaus, the herds of buffalo
migrate into the more pro-
tected reaches of the Lamar
Valley*



*(Below) Even bighorn sheep
become reasonably tame in
Yellowstone Park. A band
of ewes and lambs are shown
here pawing the snow from
the winter pasture slopes*



Rushing for his life, the young man climbed the fence. A horn ripped one trouser leg and slit the skin of the man's thigh as he leaped over to safety. Had the bull taken it into his head to charge three or four minutes earlier, when Keeper LaCombe was passing, a tragedy would have resulted, because Mr. LaCombe was an old man and would not have been able to get over the fence as did his twenty-five-year-old helper.

THE BISON OF PELICAN VALLEY

Each winter a few buffalo elude the round-up, coming down to the Ranch later for hay. A few others drift in the opposite direction to Pelican Valley, 7800 feet above sea level, near Lake Yellowstone, and there must winter as best they can. Although they occasionally paw the snow off the grass, buffalo usually root into it much like pigs, according to Mr. Joe Douglas, for many years Keeper of the Buffalo Ranch. He reports he has seen them in the spring with faces cut and bleeding from rooting into heavily crusted snow. Their beards become matted with ice, and, during their rooting movements, these beards brush the snow somewhat like brooms. The buffalo further resemble pigs in the grunts which are emitted by old and young, male and female, alike. Mr. Douglas said he has never heard them make any other vocal sound.

A few hundred head of pronghorn or American antelope, those elegant plains neighbors of the buffalo, are forced to winter in the Park, because their original prairie ranges have been settled. They are unable to cope with severe winter conditions so well as the larger animals. One day during a storm we came upon a dozen lying in a sagebrush pasture. Near by was a grove of trees which would have afforded shelter, but they preferred the open, evidently in order that they might have a clear get-away in case of danger. Snow had drifted over them until they looked like mounds in the landscape. At our approach black slits appeared as eyes, and as their heads went up in alarm, an inch-thick cloak broke around their necks. Leaping to their feet, with tattered white mantles sifting from their backs, they sped away into the blizzard. The deepening snow, which retarded speed,

meant tragedy for the antelope. During severe blizzards predators as well as victims remain inactive. When the storms clear, all come forth in search of food. The night following this storm, coyotes ran an antelope buck into a mesh wire fence which was placed on the northern boundary of the Park to keep the animals within the sanctuary. His prong horns hooked into the wire and, while he was tethered, his pursuers ate him alive. The fence has since been removed.

In addition to other killings in which deep snow alone was the necessary handicap, a unique tragedy occurred early in the winter. A young antelope doe was hit by an automobile which broke one hind leg at the heel joint; the haunch of the other was skinned by the impact. She ran out of sight, and a search by the driver failed to locate her. Hearing of the accident, we took up her trail the next morning and found that every hundred yards or so she had lain down in the snow and then risen from the blood-stained bed to hobble on. Her dangling leg dragged a troughlike track through the snow as blood also marked the trail. Within a distance of less than a mile she had bedded down six different times during the night. Finally she swam across the Gardiner River, where we discovered her wet and shivering lying on the bank. It was early in the season for coyotes to be on the lookout for big game, the snow being light and other food abundant, but they live by their wits and are not long in locating such unfortunates. Upon bringing a ranger to put her out of her misery, we discovered that she had moved on.

We took up the trail which led into some broken ground, the kind ordinarily shunned by antelope. She had hobbled through this, walking on the bone of the injured leg for half a mile. In several places she had struggled and fallen back, while climbing over banks. A fresh coyote track joined her trail, and a few yards farther on dirt was kicked up on to the snow where the antelope had whirled and plunged. Coyote tracks looped in a lace pattern about those of the doe, tufts of yellowish hair were dropped on the tracks and the crimson stains on the snow increased. After follow-



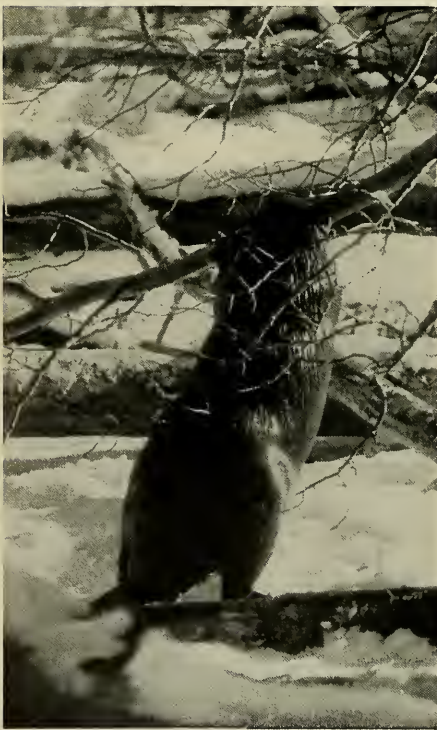
Bighorn

The horn tips of this monarch of the bighorn herd are broken and frayed from fighting many battles during the mating season



(Above) These bighorn sheep have been driven off the higher mountains by the deepening snow, but find it possible to exist at lower altitudes

At the left a beaver is shown gathering aspen tree limbs for winter storage. Below are the tracks of a marten in the snow





(Right) This rabbit has changed his coat to one that will synchronize with the snow, but, before the snow falls, he has become more obvious to the eye

(Below) A ranger on patrol fords Yellowstone River. In few districts of the park can horses be used during the prolonged winter



ing a few hundred yards of this evidence, we heard the bleat of the doe. Peeking over a bank into a dry wash, we saw a coyote dashing about like a matador, tearing bits of flesh from the skinned haunch. The antelope, crippled and trapped in the gully, was able only to whirl and bleat. Obtaining a picture would have required stalking closer and prolonging her agony. The ranger shot, first the coyote, then the doe. What a pity the speeding motorist could not have seen the fate of that beautiful creature. With the improvement of the highways in the Parks and the inevitable increase of speed, dozens of animals are injured or killed each season.

MULE DEER AND COYOTES

When the snow deepens to two and a half feet or more, mule deer also provide meals for coyotes, who travel easily over snow. In a valley near Hellroaring at least eleven deer were devoured in a few days following a heavy storm. Tracks showed that the coyotes, when their paws started to sink, squatted on flattened legs, using them somewhat like skis, as they crawled over the surface on their bellies. In one place tracks following those of a doe indicated that two coyotes had slowly pressed her forward until she worked to the edge of the frozen Yellowstone River. Most of the snow had been blown from the ice and no tracks remained thereon, but what happened is indicated by the fact that a few feet from where the deer trail — flanked on either side by that of a coyote — led on to the ice, her partly devoured carcass lay. Backtracking her trail failed to reveal any indication that she was not in perfect condition, nor did it indicate any sign of a struggle before she reached the ice. Apparently the coyotes had maneuvered her on to the ice, killing her the moment she slipped. Coyotes eat mice and bugs when they are available, but when winter comes and small food is scarce, they turn to larger game.

Several dozen deer have found almost complete security by spending the winter at Park Headquarters at Mammoth Hot Springs. Coyotes seldom come near dwellings and the deer graze on the lawns, browse on whatever shrubs are not fenced from them for the winter, or they knock off

the garbage-can lids and rummage around for many kinds of scraps they relish. Then, too, they have learned to "panhandle," and as park employees emerge from the government mess, the deer stand near the door, anticipating handouts. For several years the same deer with their offspring have been returning, and for a while it was feared that inbreeding might weaken the strain, but this year late in November several wild bucks came in for the mating season, and put the tame bucks out of the running. The wild ones learned quickly from the action of the does that they were safe when people walked near by, although most of them left as the breeding season came to a close.

When the animals are not foraging, they spend much of the time resting. They lie in the snow and their beds show a fortunate providence of Nature. If an animal lies for several hours, the snow packs, yet it shows practically no signs of having been melted by body heat, so thorough is the insulation of the coat. If heat escaped in sufficient quantities to melt the snow beneath the body, the animal might freeze down during cold snaps of thirty to sixty degrees below zero.

FUR-BEARERS

However, Nature in her providence is not always kindly. In the matter of protective coloration seasonal and coat changes are not always synchronized, particularly when winters are mild and snows come late. At such times the rabbits, both Jack and snowshoe, are white spots on the drab landscape. Although Nature seems to have betrayed them, a partial compensation for being so conspicuous lies in the fact that one of their enemies, the weasel, has likewise become white and is more easily seen.

If one skis into the interior of the Park, he may see some of the valuable fur-bearers. Beaver, which generally remain in their lodges except for short dives to the storage pile or the refuse spot, and who ordinarily reveal their presence only by the steam which arises from ventilation holes in the roofs of their houses, during the cold weather, sometimes appear along the open streams which drain from thermal districts.

The blowing spray from the geysers collects in fantastic mounds about the trees in their lee, some of them being bowed to the ground by the congealed vapor



Doctor Chapman beside the warm Gardiner River when the temperature was 30° below zero, Fahrenheit. Frozen vapor heavily weights the branches of the trees and shrubs



Wherever hot springs in the bed of Lake Yellowstone keep the ice open, the traveler will likely find otter sitting on the edge, sunning themselves or eating fish. Upon approach, they will growl as they slip into the hole and disappear, the water lapping smoothly around their cone-shaped tails.

Tracks of the pine marten and their miniature counterpart, those of the weasel, are frequently seen because these animals are active on land and are tireless travelers. The snow over meadows is often crocheted with tracks of weasels which disappear into small tunnels and reappear on the surface as they carry on a restless search for mice. One winter two rangers came upon fresh marten tracks as a snow storm was breaking up. They took up the trail in order to learn something of the animal's range. After following the trail for about fourteen miles that day, the men had to abandon it, never having come within sight of the marten.

A PINE MARTEN SERENADE

These fur-bearers often come to shelter cabins for bits of food and will accept anything from jelly to meat. One midnight in February, while on a ski trip into the Park, one of the authors of this article was awakened by a pair of pine marten which broke into a serenade like that of cats, except that the tone was a little lower in pitch and the serenaders far less stationary. Under the floor, up the log walls, over the roof, down a corner, out through the forest, up and down one tree after another, back to the house, and over the circuit again and again went the pair, easily traceable in the dark by their constant racket. Even though they did sound much like back-alley cats, the thought that one was being serenaded by such rare and gorgeous creatures was adequate compensation for the lost sleep.

In contrast to the hard struggle of most of the hoofed animals is the easy winter life of the bear. Grizzlies den up when permanent snows come to the high country about October, and the black bears go in when permanent snows cover the lower country, a month or six weeks later. The old idea, however, that the bear spends the winter in a state of torpor is being dispelled. During the winter of 1932-33 a crew which was

encamped at the Golden Gate to construct a highway tunnel made some experiments on black bears which had denned near by. The life of these bears was not so easy that winter. When rangers were not around, the laborers threw rocks and rolled boulders into the dens. The bears growled, came out bristling, woofed at the intruders, often charged a few steps, then retired. Sticks of dynamite were also tossed into the dens. The bears came out immediately after the explosions, growling and confused. After waiting outside, apparently for the fumes to disappear, they returned to their troubled beds. Such disturbances were kept up off and on during the winter, and the laborers told us that the bears never showed any evidence of having sunk into a torpor, characteristic of true hibernation. And that was during the extremely cold winter, when a record low for the United States of sixty-six degrees below zero F. was reached in the Park. Similar observations have been made by rangers stationed at Old Faithful, where black bears den up under buildings. Whenever the rangers have looked in, the bears have greeted them with open eyes and growls, showing that they were very much awake. Because of the inaccessible places where the grizzlies den, and because of the probable treatment an intruder would receive, few experiments have been carried on with them. Those who are in districts affording such opportunities, prefer to let the other fellow find out for himself.

When winter has run its course, many of the animals appear to have reached the last stage of decrepitude. Bones poke up beneath sagging hides, and the backs of the deer and elk look badly "moth-eaten" by the parasitic grubs which fester in their backs and blotch their coats. If green grass sprouts forth suddenly in abundance by a pathetic irony, many of the grazing animals that have been barely able to pull through, "spring-kill" on the feast. Of course, this ill wind brings fat pickings for the predators. Such is the tenacity of life, however, that the majority of the wild creatures pull through to enter an easy season of abundance in which to bear and rear their young and to recondition for the following winter.

The Netsuke of Japan

An account of certain miniature Japanese carvings featuring the mythical stories they tell

BY HERBERT P. WHITLOCK

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In Japan, where the art of carving both beautifully and delicately in ivory and wood has been carried to such extraordinary perfection, a particular type of carving is unique. The Japanese costume is devoid of pockets, with the result that each person usually carries a handsome bag or detached "pocket" which he attaches to his girdle by means of a "netsuke." This decorative piece, usually of ivory or of wood, is almost invariably a little work of art, and the specimens that illustrate the following article are from the Drummond Collection which recently has been put on display at the American Museum. The word is not pronounced as it is spelled. An approximation of the Japanese pronunciation might be written phonetically as follows: Netski.

—THE EDITORS.

THE Japanese carver in ivory practices an art which is in many respects essentially different from that of his brother craftsman, the Chinese lapidary who works in the harder mediums. His is a handiwork allied in material and technique with that of the wood carver, and, indeed, he often resorts to wood and handles it with the same facility with which he uses ivory.

Unlike the Chinese carver of jade, whose tools are few and simple, the Japanese ivory carver produces his small, realistic works of art with the aid of a multitude of knives, burins, gravers, chisels, drills, files, and saws. A full set of these implements contains upward of fifty pieces, including right-handed and left-handed burins, whose purpose would be obvious to a golfer who uses a left-handed club when the golf ball lies close to the right side of an obstacle, such as a tree root.

Such an array of carving paraphernalia has rendered possible a perfection in the representation of detail which in many cases is little short of microscopic. So meticulous indeed is the work of the Japanese ivory carver, that it often includes a completeness of rendition undreamed of by an Occidental artist. One of the pieces in the Drummond Collection, for instance,

depicts a huddle of twenty mice which not only are reproduced to the last hair on the exposed or upper side, but whose feet and claws, not to mention the articulations of the tails, also are faithfully shown on the under side, which is usually hidden from view.

Ingenuity as well as skill is shown by these clever craftsmen, as when they represent a monkey that is capable of running in and out of a hollow log, or an ivory toy representing a street actor that is actually capable of changing his masks by means of the flick of one's finger.

Much of the finest ivory carving in miniature pieces takes the form of netsuke, the buttons or bobs that terminate the cords to which the various girdle appendages are attached, and prevent these cords, when passed through the girdle, from slipping out again. These netsuke, although varying somewhat in size, are, from the nature of their use, small and compact, and are of almost infinite variety in design. There is hardly a legend or folk story known to Japanese legendary lore which has not at some time or other inspired the design of one or more of these clever little carvings. They are dramatic, they are philosophic, and very often they are highly humorous,



Skulls are very popular subjects for netsuke among Japanese ivory carvers. The decidedly macabre sentiment which attaches to a medicine box (inro), such a forceful reminder of mortality, is thoroughly consistent with an art that emphasizes the grotesque and the abnormal



The legless Daruma is a favorite toy among Japanese young people, and is often reproduced as a snow man by Japanese boys. The little netsuke above does not, however, depict such a snow man, but a toy Daruma of heroic size made of papier-mâché

The odd little figure of Daruma is one very often met with among ivory netsuke. Daruma was a sage who, according to tradition, introduced the Zen sect of Buddhism into China. It is said that he remained seated, immovable, absorbed in meditation, for a period of nine years, at the end of which time his legs had "rotted away." He is usually represented in the act of stretching his arms at the conclusion of his long meditation, with his body enveloped in a garment like a bag





Among the many legends to be found in Japanese folklore is one relating to the "foreigners," strange races of people which like Othello's "men whose heads do grow beneath their shoulders" have some singular physical abnormality. By far the most famous of these and the ones most often represented in ivory and wood carvings are Ashinaga and Tanaga. Ashinaga has tremendously long legs and carries on his back Tanaga, whose enormously long arms reach down into the water, when Ashinaga wades out with him in order that they may gather the sea food upon which this cooperative pair lives



The fantastic figure above, executed in wood, represents one of the attendants of Riujiin, The Dragon King of the Sea. He wears upon his head a sea dragon, and holds in his hands the fabulous jewel that controls the tides



The Palace of Riujin is shown in this ivory netsuke as being entirely included between the shells of a clam. Another conception makes it a sort of "cloud castle" that materializes from the "breath of a clam"



This ivory netsuke depicts the grotesque figure of Kosensei the Gama Senjin, or the Sage with the Toad. He is always represented with a toad crawling over his person. Sometimes this is represented as the mystic three-legged toad, but oftener it has its full complement of legs

Upon the broad surface of this ivory lotus leaf a priest and an oni, the Japanese word for devil, are engaged in a match of udesushi — arm wrestling. The identity of the oni is very apparent because, besides having rudimentary horns, he has only three fingers on each hand, and three toes on each foot. We are almost led to wonder if the priest really knows with whom he is contending



A Japanese street actor is called Shishimai, and plies his trade about New Year festival-time much as does a London "Punch-and-Judy-Shoe" man. The little ivory carving below is in reality a toy representing Shishimai, and is quite as capable of changing its mask as is the actor himself. A clever little wheel inside the figure revolves to a flick of the finger so as to show successively five entirely different masks. The illustrations show two of these





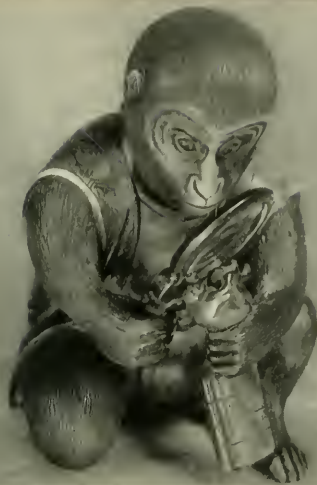
Like the Chinese, the Japanese are fond of depicting fabulous animals. One of the most richly variant of these is the Kirin, derived from the Chinese K'ilin or unicorn. The illustration at the left shows a standing Kirin executed in light-colored wood. This variety of unicorn has two horns instead of one, and seems to be covered with scales



Many of the dances, of which countless numbers are performed in Japan, are religious in character. The subject of the tiny netsuke above is performing Sambaso, the Earthquake Dance, said to have originated early in the Ninth Century to stop the disastrous effect of an earthquake. The mitre-like cap worn by the dancer is decorated with the red disk of the sun



Raiden, the Thunder God, depicted in this little ivory netsuke, has a distinct demonic aspect. The face and rudimentary horns are those of an oni, as are the two claws that decorate each foot, and the three fingers on each hand. He is shown with the drum that he beats to produce thunder



The monkey depicted in this highly humorous netsuke is looking through a magnifying glass at a netsuke carved to represent himself. One could almost imagine the monkey at which he is looking to be looking at a smaller monkey, and so on as far as one cares to carry the illusion

Hotei, the most popular of the seven "Gods of Luck" among Japanese netsuke carvers, is always represented, as in the example below, with a superabundance of flesh, and a very winning smile. Indeed, his generously extensive stomach furnishes a wrestling ground for the two little oni who are entertaining him. He may truly be described as carrying his Madison Square Garden with him

Masks are indispensable adjuncts to the Japanese Nō dances as well as to other theatrical performances. Consequently, they are very often depicted in ivory by the netsuke carvers, either singly or in such groupings as shown in the example below, which presents one or more grotesque faces on whatever side is turned to the observer





Wrestling is as popular in Japan as dancing. This ivory netsuke represents a throw invented by a celebrated wrestler who overcame his opponent when lifted by the loin cloth. This is known as Kawasu's throw

The subject of this beautifully carved ivory netsuke group is none other than Emma, the august Regent of Hell. He is represented as taking a bath while two attendant oni faithfully scrub him. It would be interesting to know whether the liquid is melted sulphur or boiling oil





Shoki,
Queller
of Demons

Intimately associated with the demonology of Japanese myth is Shoki the Demon Queller. This mythical being, who has furnished the subject of many netsuke, was known in China as early as the Tang dynasty, and was the sworn foe of all the oni or devils. In this netsuke he is depicted as hunting down and capturing several oni in a covered tub



Kijohima, the heroine of this netsuke story, was the daughter of an innkeeper, who fell in love with a holy monk, named Anchin. Upon her advances being met with stern refusal, the love of Kijohima turned to passionate hate, and she summoned to her aid the infernal deities. She pursued Anchin into the temple, where he took refuge under the great bell, which was ten feet in height and enormously heavy. Kijohima, now consumed by a fury of baffled passion, began to undergo a change, her face became a witch's mask, her body became sinuous and dragon-like, and, as she wrapped herself around the great temple bell, flames, emitted from her person, melted it, effectually consuming the unfortunate object of her literally "burning passion"

The subject of this ivory netsuke is Benkei, a hero of the Twelfth Century, famous in Japanese legend. It is said that he was eight feet in height and had the strength of one hundred men. One of his celebrated feats of strength was the carrying away of the temple bell of Miidera. This incident is depicted with great wealth of detail in the carving shown below



because the pursuit of realism in art leads to the grotesque and the abnormal.

It may seem odd to us that the total absence of pockets in Japanese attire has so enriched an art, to say nothing of having produced a devoted band of netsuke collectors. Among these latter were the late Dr. I. Wyman Drummond and his father, James F. Drummond, and it is from Doctor Drummond's collection, now in the Drummond Memorial Hall of the American Museum, that the illustrations for this article are taken. In making a selection from the wealth of material contained in this famous collection, which includes more than 500 carefully selected netsuke, the writer has been at pains to choose those which have a story to tell rather than those whose high artistic worth transcends their mere interest. But, since the ivory artists of Japan never produce an unworthy work, choose as we may, these charming little carvings always appeal to our sense of beauty and fitness.

Even the grotesque ugliness of Tanaga or one of the attendants of Riugin has its enigmatic charm no less than has the captivating serenity of Wang Mu (pictured in "Jade, Amber, and Ivory," *NATURAL HISTORY*, September, 1934), or the infectious joviality of Hotei. We come to feel that these fabulous worthies have a reality akin to Peter Pan or Long John Silver, and as we all are well aware, that reality constitutes the acme of art.

A question that is often asked and that is somewhat hard to answer is "How old is the oldest ivory netsuke?" One does not hear of any antedating the Eighteenth Century; in fact, it is said that ivory netsuke carving began with the work of Yoshimura Shuzan of Osaka, who lived and worked early in that century. The Eighteenth Century ivory netsuke, however, supplanted similar work in wood, which latter dated from the Ashikaga period (1394-1573 A. D.).

All of the best ivory carvings of Japan are signed by the artists who made them. Tiny characters, usually filled in with red, appear in inconspicuous places on even the smallest carvings, and announce to the discerning eye of the expert that Masatoshi or Tomotane of Kyoto created the particular masterpiece.

Even in the matter of subject it is possible to recognize the work of a certain artist specializing in the portrayal of warriors, as contrasted with the work of one whose forte is the carving of demons or masks. And, as in all Japanese art, throughout this handieraft runs the touch of realism like the golden thread of Truth.

A story that the late Doctor Drummond delighted to tell (I have heard it many times from him), runs something like this:

A wealthy Japanese nobleman once said to a craftsman in bronze, who belonged to his entourage:

"I wish you to make for me a sword guard that shall depict a crane flying across the disk of the full moon."

"Very well, Master," replied the artist.

Many months elapsed before the nobleman again summoned the sword guard maker.

"And have you yet made for me the flying crane and the moon disk?" said he.

"Not yet, Master," was the reply.

Years passed and finally the noble patron said to his servant:

"Why have you not fulfilled my wish and executed in bronze a crane flying by moonlight?"

"Master," replied this supreme realist, "every moonlit night have I watched the face of the moon these many years, but never have I had the fortune to see a crane flying across its silvery disk."

And so well did his master sympathize with the high ideals of his art that the matter was dropped and the sword guard was never made.

Holland Defeats the Sea

For two thousand years the people of the Low Countries have fought the sea, and now are about to win the greatest of their struggles against it

BY HAROLD WARD

Photographs supplied by courtesy of the Netherlands Railway

HOLLAND is an engineer's paradise. From the time when the ancient Batavians — of whose valor Julius Cæsar was well aware — lay claim to a sponge of earth trapped between three rivers and the North Sea, the Netherlands have been a battleground between man and the elements. Treacherous, yet of astounding fertility and charm; cradled upon waters which by turns threatened a nation and built an empire; inciting to courage by its very desolation; compelling unceasing vigilance from a people whose very lives depended upon a long, gray line of ramparts against an ocean whose child it is — the soil of Holland has yielded to man's needs only through man's intelligence, ingenuity, and resourcefulness.

In this warfare of centuries North Holland has played the major rôle — though southward, in the island-network of Zeeland, the struggle has been sharp and bitter. North Holland, geologically among the youngest of lands, is peculiarly a product of the waters; there the Rhine, the Meuse, and the Scheldt, with their tributaries, have laid down the fertile sediment which seemed, to a gold-maddened Philip the Second of Spain, worth the butchery of hundreds of thousands. Great, sprawling lakes dotted the landscape: Beemster, Purmer, Schermer, and Haarlem. The first three of these were attacked and conquered during the Seventeenth Century — the Schermer last, in 1632. Not until two centuries had passed, was the demon, Haarlem Lake, vanquished, leaving behind more than two score thousand acres to be converted into crops by the indefatigable Dutch peasants. Up to the year 1600 the Netherlands had lost to the sea, by floods, storms,

and tides, 1800 square miles of land — of which 1300 square miles had been reclaimed. With success the Dutch engineers grew more confident, more skillful — and turned their minds eagerly to the greatest problem of all — the one-time Flevo Lake, whose gradual expansions under the impact of floods and immense tidal currents finally established contact with the North Sea. Thus came into being the Zuider Zee — and with it the stupendous dream of its eventual reconquest, by and for the descendants of the "Sea-Beggars" who feared nothing in heaven or on the earth.

The reader may judge how they have realized this dream.

* * * * *

A few weeks ago there appeared a brief news item under the headline, "Refugees settling Zuider Zee land; German Jewish colony in the reclaimed area opened by the Netherlands." Ten days later there was another, but still tantalizingly short account, "Holland's Zuider Zee now supports colonists." Behind this casual print is a drama which has been going on for a thousand years, and is likely to continue for another thousand — the drama of Holland's struggle with the sea. Imagine a country of some 13,000 square miles, of which nearly one quarter is below sea level, and one tenth occupied by an arm of the North Sea which has made history and tragedy for the Dutch since the year 1295. Place on this area about the size of the state of Maine a population of more than 8,000,000 representing a density of over 600 per square mile (comparable to that of Japan, and fifteen times that of the whole United States); allow to this population five and one-half million acres of remarkably fertile land on which it must depend for the bulk of its food crops; give to it, of other land-

The Morspoort



A Gate at Leyden

This particular gate, constructed toward the end of the Seventeenth Century, is one of the only two that now remain. In the center of the city there is a more interesting and far more ancient structure. On an artificial mound, erected in Roman or Saxon times, stands De Burcht, an ancient castle. The mound on which it was erected is representative of the earliest efforts of the inhabitants of the country to create dwelling places above the ever present menace of the waters



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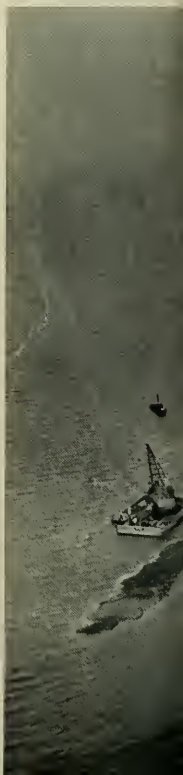
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A test polder at Andyk. This small field, one of the first steps in the reclamation of the Zuider Zee, was created in order to learn how cereals would behave on the salt-soaked soil

The picture at the left and the one below illustrate certain of the engineering features of the dam, the sluices, and the pumping plants



© K. Maaskant, Wieringen



The engineers of Holland have long since reduced to a formula the method of draining land that lies below the level of the sea. The ditches shown in this picture are an essential part of the reclamation of such land

New Land in the Making

(Below) The major feature in the preliminary work of reclaiming the Zuider Zee was the construction of the dam separating the area to be reclaimed from the North Sea



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consuming factors, 600,000 acres of forests, 4500 miles of canals, and 15,000 miles of roads, 300,000 horses, 485,000 sheep, 130,000 goats, 2,000,000 hogs, 25,000,000 chickens, and 2,360,000 cattle—and it becomes as clear as daylight why the Dutch Government decided, back in 1918, that the odd half-million acres of lush soil covered by the waters of the Zuider Zee must be restored to human uses.

One acre of land for every inhabitant; of actual farm holdings 90 per cent are of less than 50 acres, and more than 50 per cent of less than 12 acres: not an encouraging picture for a country known since the time of Julius Cæsar for its pride and love of independence! Compared with the gigantic "collectives" of the Soviet Union, the vast spaces of Australia, the Argentine, and the United States, Holland (minus its colonial possessions) is not exactly a favored nation as regards its natural resources. Just for that reason, perhaps, the Dutch people have become a classic example in making the most of what they have. Is not the motto of the Lion of Zeeland *Luctor et emergo*—"I struggle and emerge"? And was not the Zuider Zee itself made to fight for the Seven Provinces when the Duke of Alva sought to make them, and the whole of Europe, safe for the Inquisition?

BEGINNINGS OF THE CONQUEST

First steps in the conquest of this unruly Old Man of the Sea go back to 1877, when plans were discussed—and discarded. Ten years later the newly-formed Zuider Zee Union got to work in earnest: the chief of its technical committee, an engineer of genius named C. Lely, made the most elaborate investigations, as a result of which he drew up plans providing for the reclamation of four separate plots of ground or "polders" totalling 555,000 acres. Every detail, from the gigantic main dam stretching for nearly twenty miles across the open sea between Wieringen Island and the Frisian mainland, to the drying out of the reclaimed soil, was attended to so carefully that the Lely plans were adopted by the Dutch Government as the basis for the actual work. Not until 1918, however, was

this work finally authorized, and further delays, due to the War, to the growing public debt, and to other internal difficulties, postponed regular operations until 1926. Six years later, in 1932, the North Sea was finally shut off from its landward arm by the greatest dike in the world, and the first "experimental polder" of 48,000 acres south of Wieringen Island (now actually part of the mainland) was put under cultivation. "Nieuwersluis" is the name given to the 175 acres being occupied by the German-Jewish colonists under a ten-year lease from the Dutch Government.

As laid down in the Lely blueprints, the Zuider Zee project provides for a central core in the form of a fresh-water lake, the Ysselmeer, of 560 square miles, to take care of the flow from the rivers Yssel, Rhine, Scheldt, and others. The four polders will adjoin this lake, from which they will be assured, through a most elaborate drainage and canal system, of unlimited supplies of fresh water. It is expected that the work itself will continue more or less steadily for the next twenty-five years—until 1958; each new plot of reclaimed ground coming into the market at a rate permitting the Government to dispose of it profitably. This question of a reasonable return on the investment assumes considerable importance when it is realized that the cost of the main dam alone came to \$35,000,000, and that the total cost of the entire reclamation project (maintenance not included) will be more than half a billion dollars. Despite the colossal proportions of this undertaking, direct human labor upon it is not expected to be in excess of about 3000 men during the next ten years, the number decreasing thereafter. This is not a very marked "improvement" of the Dutch unemployment situation, with some 300,000 "officially" jobless people to be provided for.

There is, however, another side to the picture, showing that, if the Zuider Zee reclamation project is a gamble against nature and against complex economic forces, the probable gains are well worth it. The most important of these gains—or at least advantages—are worth summarizing, if only because each of them separately and all of them taken together give a vivid

How the Zuider Zee is being reclaimed. The portion of this map that includes the IJsselmeer (Ijssel Lake) and the several areas marked "reclaimed land" were formerly the Zuider Zee. The great reduction in its area is thus apparent at a glance. It may be noted that "Ijsselmeer" is also spelled "Ysselmeer," and so appears in the accompanying text



idea of the gallant struggle going on between one very small country and a terrifying array of hostile elements.

Since 1846 — to begin with recent times only — a total of 250,000 acres of valuable crop and dairy land have been retrieved from the sea: a rate of 10,000 acres a year. Every one of these acres, despite the cost of dikes, drainage, and other maintenance charges, has paid for itself many times over. The most dramatic of these gains — that resulting from the impounding of the reckless Haarlem Lake at a cost of about \$6,000,000 — added 42,000 fertile acres. So reclamation work not only can but *must* pay.

Second, the alluvial soil ("deposit-land" as it is known to geologists) of which the greater part of the Netherlands is composed is famous the world over for its productivity — as we know from Egypt, whose land is also a gift of the rivers. In wheat, for example, the yield per acre from Dutch soil is 46 bushels: almost three times the yield in the United States, and equalled only by Belgium, Denmark, and the Irish Free State. For rye the figure is 33.6 bushels per acre for Holland, as against 12 for the United States; and for oats 59.8 against 30.1 for this country. Add to this the further fact that the Zuider Zee lands, when finally dried out and "de-salted," will be

loaded with the accumulated fertilizing chemicals of centuries of submergence, and you have another clinching argument for putting back the sea.

Third, the now completed main dam, plus the smaller one from the other extremity of Wieringen Island to North Holland and the supplementary "ring-dikes" to be constructed, will make possible the abolition of some two hundred miles of the old Zuider Zee dikes, thus saving an estimated \$60,000 a year in maintenance costs, to say nothing of the added security.

Fourth, along the 112-foot top or "berm" of the main dam will be laid not only vehicular and pedestrian roads but a double-track railway. Besides lessening the distance and running time between Amsterdam and the North — a very great advantage — this will considerably relieve traffic congestion along roads which, with the canals, dikes, embankments, and buildings both commercial and residence, account for some 840,000 acres of precious Dutch soil. The fact that final closure of the Zuider Zee will permanently deprive Amsterdam of its direct outlet to the sea is neutralized by the existence of the famous Noord Zee Canal, whose terminus at Ymuiden today boasts the largest navigation locks in the world — not even excepting those of the Panama Canal.

One of Holland's many lovely orchards, similar, no doubt, to those through which Admiral Boisot and his indomitable "Sea Beggars" sailed their fleet when, under the leadership of William the Silent, the country was flooded during the siege of Leyden



Country

From this patch of land come some of the world's finest tulips and hyacinths. It lies near Haarlem, in the vicinity of famous Haarlem Lake, reclaimed about the middle of the Nineteenth Century





Rotterdam, with ready access to the sea, has benefited as a result of the comparative nautical isolation of Amsterdam brought about by reclamation projects

and City

A bridge crossing one of Leyden's many canals. This city stands in the midst of a large region that lies below sea level



Delft and one of its canals. This is, in reality, a carefully controlled stream, running from Leyden, past the Hague, and on to Rotterdam



Fifth, as mentioned above, the fresh-water supplies impounded in the newly created Ysselmeer will be of incalculable benefit for crop and livestock purposes, and also for industry. Losses directly traceable to absence of or deficiency in fresh water have been estimated at close to \$2,000,000 a year. Huge locks in the main dike will give lake-access to vessels up to 2000 tons, thus permitting a considerable amount of water transport. The very elaborate drainage system to be used in connection with this lake, together with the dikes, sluices, locks, and subsidiary reservoirs, allows for a rise in level of nearly four feet. This height has been calculated on the assumption that the *worst possible storms, floods, rains, tides all occur at the same time* — a coincidence which has happened only once in the last seven hundred years. Worth noting in this connection is what the Dutch engineers call “overtopping,” one of the most serious factors in a breakdown of the dikes. By this is meant the passage of high waves to the *land side* of the embankment, where they may effect much damage by scouring the earthworks and thus lessen resistance to pressure. It was in this way that Holland experienced one of the worst flood disasters in recent times, — the inundation of 1825, which submerged thousands of acres around the picturesque island of Marken below seven feet of water. Control of this factor is provided by the *slope* of the embankment on the water side.

ZUIDER ZEE FISHERIES

Sixth, the gradual liquidation of the centuries' old fisheries of the Zuider Zee: a problem which, because of the “human element” involved, looms much larger in the public mind than its economic significance warrants. Within recent years these fisheries have rarely supported more than about 15,000 people, of whom half actually did the work, with the help of some 3000 vessels. Taking the “catch” in the years 1910–1927 (herring, anchovies, smelt, flounder, and shrimps) at a yearly value of \$1,500,000, we get an annual income *per fisherman* of slightly more than \$200 — certainly not a generous return from a million acres of shallow salt water, shared

among 15,000 dependents! Already, in order to supplement these meager earnings, the fisherfolk have been turning to the land and to dairying — for which more stable occupations the Government is providing considerable aid in the form of experiment stations, training schools, etc. Those who, because of age or temperament, are unable to give up the sea, will be settled on fishing grounds to be established off the coast of Wieringen Island — or they may have a try at the far less exciting work of exploiting the fresh-water fisheries it is planned to develop in the new Ysselake.

Seventh. Basic to the entire Zuider Zee reclamation project will be the 900 square miles of new arable land to be made available for a population which — contrary to general belief — is growing at a rate of about 100,000 a year. When, in about thirty years' time, these half million acres are actively producing food, dairy, and livestock products, it is confidently expected by the Government that a total of close to 300,000 people will be supported either on or by them. Theoretically, the average plot would be of about 85 acres, although in practice many of the holdings will be much smaller — and it must not be forgotten that the present land prices in Holland range around \$400 per acre. The Government, however, has professed its willingness to advance 70 per cent of the occupation costs to those who acquire at least 50 acres of the new land, spreading the repayments over a period of twenty years. Revenue from the fully reclaimed land is estimated to be in the neighborhood of nearly \$40,000,000 a year — an enormous increase over the sums realized from the fisheries which, with floods, storms, and costly technical maintenance, represented the principal “advantages” of the Zuider Zee. But whether, by 1958, the world economic situation will allow any government to earn anything under the still prevailing rules of the game is the question — the question on a favorable answer to which Premier Colijn and his government are willing to stake half a billion dollars of capital costs, and a very generous annual outlay for absolutely unavoidable maintenance costs.

Another less publicized but quite dra-



Conquered by Science

By means of thousands of these old windmills the original work of reclamation was carried to extraordinary lengths. Where, however, such power plants formerly pumped the always threatening water from the drainage ditches to the streams and canals that took it away, now they are almost entirely replaced by huge and ultra-modern pumping stations situated strategically all about the country



© K. L. M.

A view of a section of reclaimed land. In the great new "polders" reclaimed through the Zuider Zee project, scores of new communities are being created, in order to care for Holland's rapidly growing population

One of the beauty spots of the Hague. Oddly enough, though Holland's capital is situated on land that is well above sea level, it is not an ancient city. In the Thirteenth Century it was only a hunting lodge and did not receive the status of a town until early in the Nineteenth Century



matic advantage of this project must also be mentioned: that of national defense. Those who know their history need not be reminded of the rôle played in Dutch independence by the dikes whose deliberate destruction reduced all purely military assaults to a pathetic fiasco. And, at a very critical stage during the late War, when the Dutch government and people were gravely menaced by unlawful invasion of German troops, it was for a time merely a matter of lifting a telephone, and giving a few cryptic orders before huge sluices would rise, and the sea begin its dread work of submerging thousands of acres — and enemy machine guns. Today every detail of the Zuider Zee reclamation is being checked against the needs of similar defense: the Dutch "Waterstaat," one of the most powerful bodies of technical men in the world, has seen to it that the entire complicated system of dikes, canals, sluices, locks, reservoirs is integrated for the purposes of war as well as of peace. Special "flood-sluices" arranged at strategic points, with every facility for quick communication with the central government, are maintained in perfect condition at all times, and each of them operates with the precision of clockwork. What is particularly notable in this huge task is that the main pumping stations at Den Oever and Medemblik are so constructed that they can operate at full capacity even if the structures are submerged up to sixteen feet from the base — no small advantage in case an "act of God" (or of man) should bring about a temporary return to marine existence on an area whose soil is more precious than gold or rubies.

The engineering features of this colossal attempt to succeed where King Canute failed could be — and have been — the subject of volumes. A few words on the above mentioned Medemblik pumping station (at the southern terminus of the Wieringen polder) may fitly conclude this very brief account.

In a water-tight structure of reinforced concrete are housed three powerful centrifugal pumps, operated on a 3000-volt current "stepped down" from the 50,000 volts transmitted from Alkmaar, eighteen

miles away. Working at full capacity, each pump can drain the land and subsoil of 80,000 gallons per minute: 4,800,000 gallons per hour, 115,200,000 gallons per 24-hour day — a grand daily total for all three pumps of 345,600,000 gallons, or more than one and one-half million *tons* of fresh water during one rotation of the earth around its axis! Needless to say, operation at such a rate is not expected to last beyond short periods of time. When the polders are fully reclaimed, it is estimated that the Medemblik pumps can perform their due share of work in a total of 1500 operating hours a year, at a power expenditure of 2,500,000 kilowatt hours. This work, all accomplished by electrically driven machinery tucked away in an inconspicuous building some fifteen feet below the level of the sea, will take care of an area of 36,000 acres, on which rainfall, percolation, and occasional overflows will deposit, in a year, moisture equivalent to 35 feet of water.

Two more pumps, in the "Leemans" station at Den Oever (at the western terminus of the main dam), have a combined capacity of 545 tons of water per minute, more than sufficient to help out in any emergency, besides caring for their own district. The enormous quantities of water handled by these — and the other pumps later to be installed — must be carefully transmitted through a system of discharge sluices, of which there are fifteen located at Den Oever and another ten at Kornwerderzand, near the Friesland coast.

All of this human skill, ingenuity, and ceaseless vigilance in order to allow each of the 8,000,000 inhabitants now teeming within Holland's 12,000 square miles of land surface additional elbow room at the rate of a little more than *six-hundredths* of an acre per person — not counting existing and prospective livestock, roads, buildings, and other physical essentials of an ordered society. Will this stupendous gamble of a valiant people against nature and against the ever-increasing pressure of economic forces within and without her borders succeed? There are realists who doubt it — but perhaps the realists have never fully understood that what *they* now accept as inevitable was once — impossible.

Five Hundred Fathoms Deep

The World's First Photograph of a Deep-Sea Fish at Home

BY OTIS BARTON

"If Doctor Beebe and Otis Barton persist in their descents in the bathysphere, deep-sea fish may eventually have no more privacy than the traditional goldfish. Meanwhile, the fish figured in the following article has managed to conceal its identity in a cloud of light to such an extent that it is any expert's guess as to which of several known forms it may be. Nevertheless, by 1985 A.D., when entire life histories may be photographed in the abyssal depths, these first blotches of light on a black field may be treasured as the work of brave pioneers who opened up an environment that is as black as interstellar space." — W. K. GREGORY, Curator-in-Chief, Living and Extinct Fishes, American Museum.

STUNNED by the dazzling ray from the window of the bathysphere, it pauses, turns, and sinks slowly back into the blackness of the ocean abyss. It is a small bonita-shaped fish, possibly *Melamphaes*. Almost its entire side registers on the film as a sheet of flame. Only the fins and opercular openings are dark.

Thus, the world's first photograph of a deep-sea fish at home became an actuality. The picture was taken last summer, 3000 feet below the surface of the sea, through the fused quartz window of the bathysphere, which was operating off Nonesuch Island, Bermuda, under the direction of Dr. William Beebe and myself.

Also on this motion picture film are to be seen two fishlike forms that dip down for an instant into the shaft of light, and something that may be a baby squid or a larval eel passes horizontally along the lower border of the narrow ray. Outside the shaft of light nothing can be seen in this film. Neither with nor without artificial illumination have I been able to catch the phosphorescent lights of deep-sea fishes on any film, during three seasons' work in Bermuda.

Nor are these creatures 3000 feet down different from those I have often seen from the bathysphere with the aid of the powerful light. We can, of course, see many times farther than the distance at which it is possible to take photographs. I should

judge that, when the light is on, we can see organisms at a distance of twenty-five feet at least, and by their own light alone, up to twelve feet at most.

Several times, when Doctor Beebe and I have descended in the bathysphere, I have attempted unsuccessfully to make a deep-sea motion picture, holding the camera myself. Doctor Beebe telephoned the deck crew more than 2000 feet above us to burn the spot light to nearly its full brilliancy. The beam from this 1500-watt lamp is the largest and brightest that can pierce through the six-inch fused quartz window into the water. When the bulb is burning close to its rated 120 volts, the heat radiating from it is very unpleasant, so great in fact, that we have often feared it might crack the window.

On the first day of our operation last summer, however, I had better luck. As usual, the bathysphere was to be lowered with no one in it on a safety test dive to 3000 feet. I attached our telephone wires to the motor of a large camera holding 400 feet of supersensitive film, and connected the wires of the spot light with a big generator on the deck. When the bathysphere reached the bottom of its test dive, the light was burned up to at least 140 volts, and the camera turned on electrically. Apparently the greater brightness of the light did the trick. This film is a little faint to be sure, but it is the first and only true deep-sea picture ever taken.

The camera enters the bathysphere. In the photograph at the right Mr. Barton is shown making ready the motion picture camera prior to the test dive during which, with no one in the bathysphere, the camera was operated electrically from the deck of the ship from which this deep-sea equipment was lowered



The first photograph ever taken of a fish in the deep sea. The white spot in the photograph below tells very little about the fish of which it is a portrait. Nevertheless, the fact that an unattended motion picture camera can be sent 3000 feet down into the blackness of the ocean depths, and can then be operated electrically, suggests a new and practical method of deep-sea exploration which, as it is perfected, may bring to light totally new and even unsuspected facts in the greatest unexplored region of the world



Microscopes for Amateurs

Fascinating fields of exploration await the person beyond the lens of the microscope, and even the amateur can now obtain inexpensive and effective equipment with which to experiment

BY JULIAN D. CORRINGTON

IT IS usually thought that the heights of drama in nature are reserved only for those few intrepid and wealthy souls who invade the African Blue or the Polar White. The rest of us have to stick on the job of earning a living, and must seek such adventures second-hand through the medium of sound films.

Or is it that we just think we must? The trouble is that most of us don't know where or how to look for fascinating experiences in nature.

If we take a long-time view of this world of ours, and concern ourselves with the drama of evolution, no more intriguing pastime for everyday study and enjoyment may be encountered anywhere than in the investigation of adaptations, most conveniently done with the microscope. Let us cast about and see.

Adaptations are those adjustments which organisms make in response to demands of their environment. Not consciously or immediately or individually, but through long periods of time and by great numbers of individuals. All successful organisms have long since become very well adapted to their particular environment, while such poorly adjusted plants as cycads, or animals as the rhinoceros, are surviving relics of much larger and more successful groups of a bygone day. Unable to change with a changing environment, the small, modern remnant is rapidly declining.

When we study adaptations, therefore, we are feeling the pulse of racial life, and the further we pursue this beckoning trail, the more interesting it becomes. To get the meat out of this form of investigation, however, we should follow it in detail; hence the suitability and allure of small forms of life. The deer and bear may be

spectacular, but a flea, under the lens, may loom equally as large or formidable and moreover presents many concrete adaptations that are plainly evident and understandable.

Look over one of your canine or feline friends and relieve him of a few of his stowaways. Part the fur and search carefully in the neck region, where in most cases you'll observe some of these little brownies scurrying for cover. That they are not easy to capture will be quickly evident.

Put several fleas in a cage made from any convenient article of glassware, with a piece of cloth as a flooring. They will live for a considerable period without food and will provide splendid opportunity for observation of habits, especially as correlated with structures revealed by the microscope.

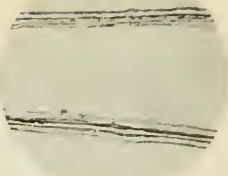
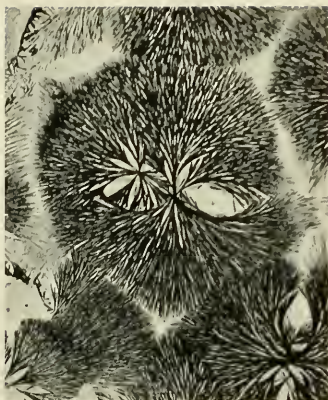
A number of other fleas should be dropped directly into 70 per cent alcohol, which kills them quickly and initiates preparation for mounting. After an hour transfer the insects to 95 per cent alcohol, and leave them for one hour or overnight, thence into aniline oil for a like period. The alcohol extracts all water from the tissues of animals and effects permanent preservation, while the aniline oil permits passage into balsam, the mounting medium, and also clears specimens, rendering them more translucent to the passage of light, which is important in obtaining a clear image.

Now comes the mounting. A blank slide and a cover glass are thoroughly cleaned by dipping in alcohol, then wiping dry and polishing with a soft cloth. Cleaned glassware should be handled by the edges only. Blot the specimen for an instant on the cloth, to remove excess oil, then place on the center of the slide, with the insect's back surface down and legs up.

Straighten the legs so that they do not

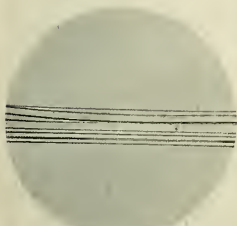
Microscopic studies of certain crystalline forms bring out new and often unsuspected beauties in Nature. The rectangle at the right portrays a greatly enlarged view of caffeine crystals as they appear through the microscope

Ward's Nat. Science Establishment



Bausch & Lomb

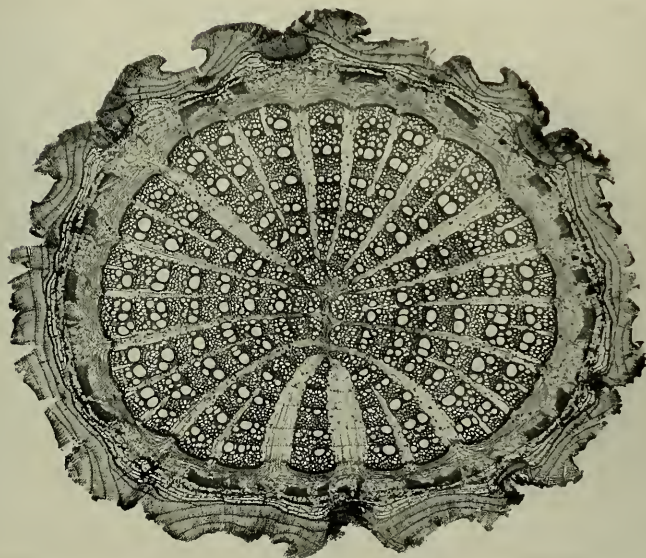
Many of the commonest materials offer fascinating opportunities for study to the amateur microscopist. In the circle above are shown two strands of real silk fibers, while the circle on the opposite side of the page shows comparable strands of rayon, or artificial silk



Bausch & Lomb

Photographed through a microscope and projected on to a screen, the greatly enlarged and splendidly detailed picture below shows a cross section of the stem of "dutchman's-pipe" (Aristolochia). The original picture was even more striking because of the brilliant coloring of red and green stains

Bausch & Lomb



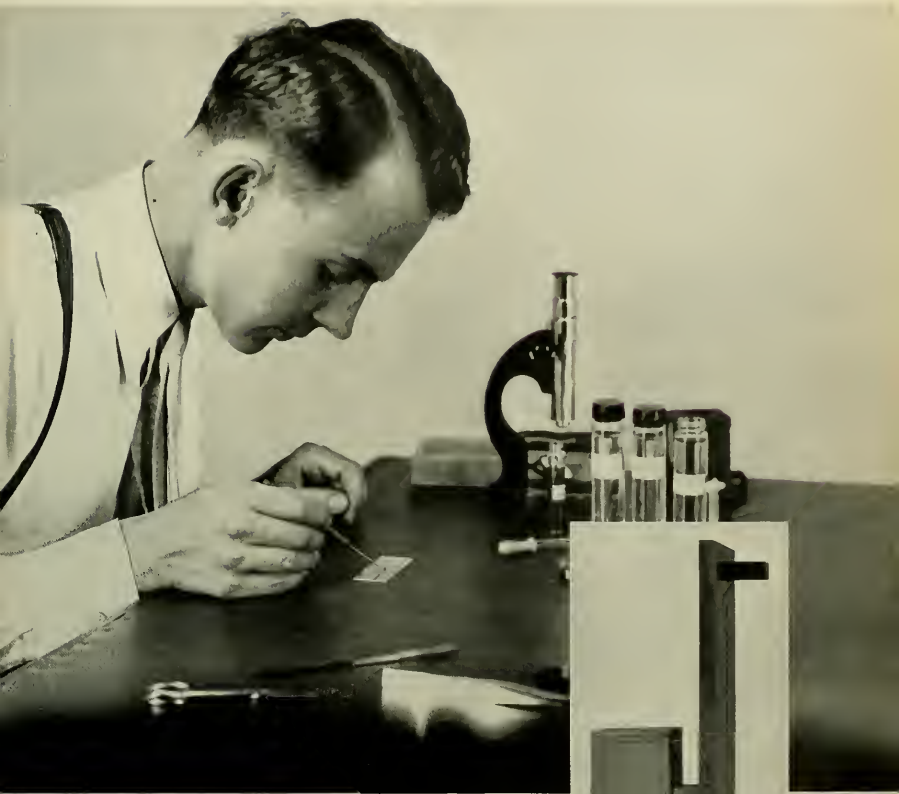


Making an exposure with one of the latest types of beginner's photomicrographic outfits. The camera is small and simple, and is equipped with a separate view finder

Projecting the image of a microscope slide on a screen with one of the simpler and less expensive of the micro-projectors. Such equipment is not essential to the amateur microscopist, but is capable of adding immensely to the enjoyment and understanding of the subject



Amateur Equipment



Some of the essentials in the amateur's slide-making outfit are shown above. The student is centering an insect leg on a slide, preceding the addition of balsam and a cover glass. At the right a homemade photomicrographic stand is shown, with an inexpensive beginner's microscope and a plain box camera in position for making pictures. The block carrying the camera slides up and down by means of the bolt passing through the long slot



overlap and are more or less symmetrical, using needles mounted in wooden handles for this manipulation. Add two drops of balsam and let the cover glass fall gently into place upon the specimen, whereupon the balsam should spread out under the cover and completely fill up the space between cover and slide, with no excess to mar the tidiness of the preparation. The exact amount of balsam to use in any particular case has to be learned through trial. If you've never turned your hand to this sort of work before, you'll find slide making lots of fun.

STUDYING THE SLIDE

After a slide is finished it must be kept level and used with care so as not to disturb or touch the cover. A better practice is to let it dry thoroughly first by putting it away in a flat position in some place free from dust, for a week or ten days. Or make a slide dryer by inserting an electric bulb in a metal box, the slides being placed flat on the top, where they will dry in two or three days. Clean and label each preparation when dry.

In studying the flea slide, note first the general adaptations of this highly specialized insect for the environment in which he lives. Imagine yourself in the flea's home, dwelling in a very dense forest of tall, slender trees, through which little light ever filters. At times giant spikes come plunging down in a glare of light through the roof of this warm, dank jungle, intent on your immediate annihilation, and at frequent intervals there appear huge forceps which attempt to impale you. That's the way the dog's claws and teeth doubtless seem to the flea.

Being well fitted to cope with these dangers, the flea has a hard shell which is smooth, shiny, and slippery, and a body that is compressed and oval in outline, very difficult for a dog's teeth to close upon, the flea often slipping from between them just as you can spurt a watermelon seed from between your fingers.

Unlike most insects, fleas have no wings, for of what use would wings be in such an environment? To compensate, however, the legs are especially well suited to creep

swiftly about on the surface of the victim's hide, to cling to hairs with sharp claws, and finally to make prodigious leaps with the third pair, after the fashion of the grasshopper, frog, or kangaroo. By means of this jumping habit, the newly transformed adult flea gains its first host, and others may pass from sickly or dead animals to more auspicious banquets.

Observe the eyes and antennæ on the head of the flea; the eyes are greatly reduced and do not consist of the usual large number of compound facets customary in insects, while the antennæ are mere vestiges lying in grooves behind the eyes, instead of being the prominent, forwardly-directed, and highly sensitive feelers generally present in free-living insects. Sense organs lose much of their utility in a habitat such as that of the flea.

The mouth parts are formed for piercing and sucking, and may be seen on favorable mounts as a pair of tiny feelers plus one or more stabbing blades, the cause of certain qualifications going to make up a dog's life. Then there are combs on the sides and rear of the flea's head, very prominent features and serving to prevent backslip during forward progression, as well as helping to anchor the head firmly in place while the flea takes his nip of dog.

Quite an array of adaptive structures in these pestiferous little fellows. Interesting animals, fleas.

INEXPENSIVE OUTFITS

If you make a good slide you can buy an inexpensive outfit to project the magnified image on a screen as part of an evening's entertainment for friends at home. The same apparatus may also be employed to throw an enlarged picture on a sheet of paper on the table, so that the insect is quickly and easily drawn by merely tracing the projection.

Then, if you are a camera enthusiast, the next step will be to take up a still more fascinating game, — photomicrography. Any type of camera may be hooked up with any model or make of microscope, and with but little practice very excellent photomicrographs can be turned out by even the rankest of beginners. Hunting with a

Under the microscope even a strand of hair, such as is shown at the right, reveals the complexity of its structure

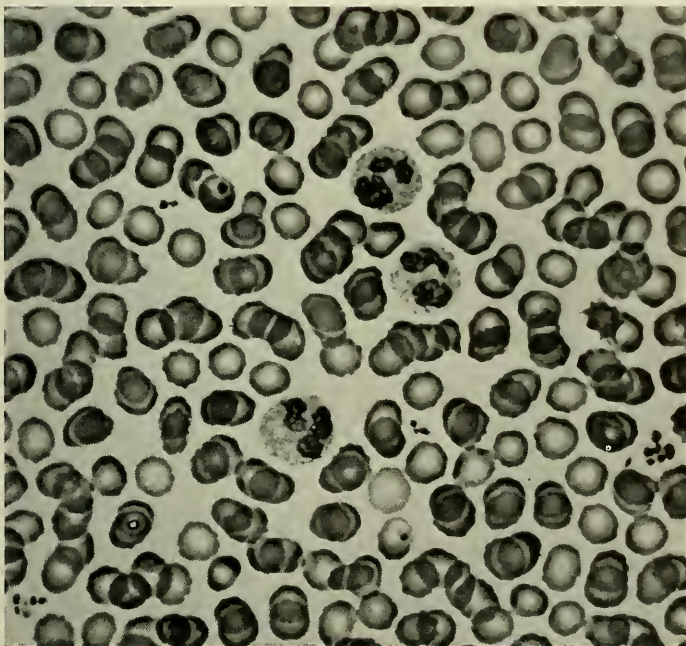
Below, an enlarged view of a portion of a human finger print reveals the intricate details upon which identification can so definitely be based

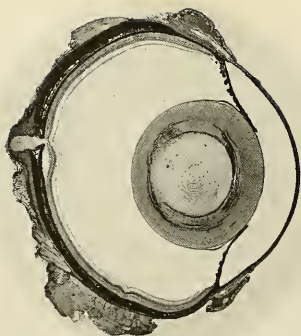
Bausch & Lomb



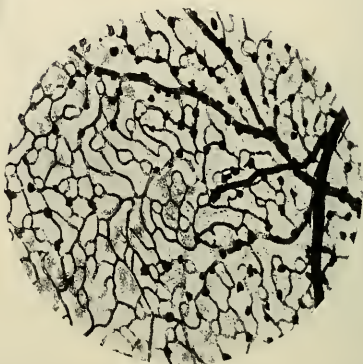
Human blood, as it appears under the lens of a microscope, is pictured below. Most of the cells shown are red corpuscles, many of them clumped together. The three larger round cells, with prominent nuclei, which appear in the center of the illustration, are white corpuscles. Tiny groups of dots showing in several places are the blood platelets

Bausch & Lomb





The circle at the left shows a median section of a frog's eye. From right to left the cornea, anterior chamber, iris and pupil, lens, posterior chamber, retina, and outer coats are clearly shown. Below is a photomicrograph of the web of a frog's foot, showing the capillary blood vessels



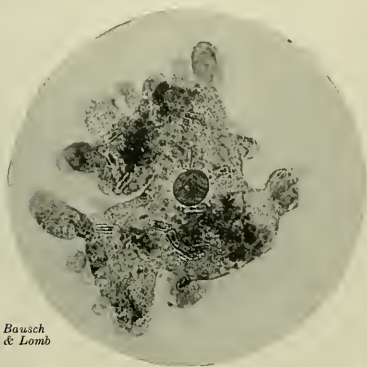
Below is a photomicrograph of a "doodle bug," the larva of the ant lion. It digs pitfalls in the sand and seizes ants and other insects that blunder into the trap. Under the microscope its "huge" jaws are shown in fascinating detail. In real life this tiny dragon is, perhaps, half an inch in length





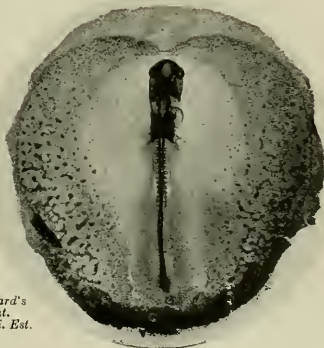
Ward's Nat. Sci. Est.

Mosquitoes can be studied to excellent advantage under the microscope. The specimen above is a yellow fever mosquito, the carrier of one of the world's most dreaded diseases. The insect is well arranged on the slide, with the result that wings, legs, and mouthparts can readily be observed



Bausch
& Lomb

Amoeba proteus, one of the most fascinating of protozoans, is shown above. The nucleus shows plainly, as well as a number of diatoms (unicellular plants) which the amoeba has ingested as food. At the right the development of a chicken's egg is shown, thirty-three hours after the fertilization of the egg



Ward's
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Sci. Est.

camera has long been considered decidedly superior to the use of the gun, both as a sport and for the skill required. When the microscope is added, the thrills are multiplied.

A stand to support the two instruments may be purchased or homemade, as shown in accompanying illustrations. Use a strong light source, a shield of black cardboard around the microscope eyepiece to block off outside light, and a ground-glass focusing plate in the back of the camera. The diaphragm should be wide open, the shutter set at time exposure, and focus at one hundred feet or infinity. Make a number of trial exposures at $\frac{1}{2}$ minute intervals each, from $\frac{1}{2}$ to 2 minutes, determine which one was best for the particular subject and conditions, then gradually acquire knowledge by further trial shots. Experiment with colored filters, using a green one for your first pictures. Place a piece of green cellophane between two glass plates, such as lantern slide blanks, and bind with gummed tape. Stand this filter between the light and the mirror of the microscope.

LILLIPUTIAN WARFARE

In a drop of pond water from a stagnant ditch or lily-pad pool, many a marvelous drama of the microcosm may be seen enacted if you, like an imaginary man from Mars, look down upon this scene as from another world. *Amœba*, that microscopically huge blob of protoplasm, will steal upon the unwary brother protozoan and embrace him with long, finger-like extensions which we term pseudopodia, or false feet, but which to the victim spell death. These pseudopodia form a cup which flows around and over the hapless organism, engulfing him in a viscous prison, where he may dash about futilely for a moment or so until overcome by digestive ferments which *Amœba* soon pours into this lethal chamber.

Now comes another giant of this bustling world, *Paramecium*, the slipper animalcule, hurtling along at prodigious speed, propelled by hundreds of tiny, lashing whips, the cilia. Encountering a particle of decaying vegetation, these cilia quickly reverse their motion, and *Paramecium* comes to an

instant stop in order to sweep large numbers of bacteria down into its insatiable maw.

Even expert microscopists never tire of the constantly changing panorama of this world of the infinitely little. There is always something new to see and to learn. If you would invade these fascinating precincts, collect some material from any standing body of water, preferably one supporting an abundance of plant growth. *Amœba* prefers lily pads, but you will be certain to secure an abundance and variety of microscopic life if you fill a bottle with ditch or pond water and then stuff in some debris to make up about one fourth of the whole volume. Include some of the decaying leaves and mud from the pond bottom and a bit of the green plants or scums growing from the bottom or floating on the surface.

Under a cover glass mount one large drop of this culture, always including a little of the debris, and examine with low power, cutting down the light. For structural observations, after studying the activities of the living plants and animals, place a drop of iodine at the exact edge where cover glass meets slide. It will run under by capillary attraction and will kill all organisms present, at the same time staining nuclei and other features not evident in the living state. Owing to the incessant motion, photography should be attempted only after gelatin has been added to the mount to render the creatures immobile.

SLOW-MOTION ELEVATORS

Perhaps your particular leaning is toward botany. If so, the microscope is an indispensable tool in your studies; for example, in the examination of plant stems, those important pathways for the materials which the plant uses in its metabolism. Cut off a one- or two-inch portion of the green stem of a young shoot, and practice making as thin sections as possible with a safety razor blade held in a carrier. The Razornife is such a tool, obtainable in many stores.

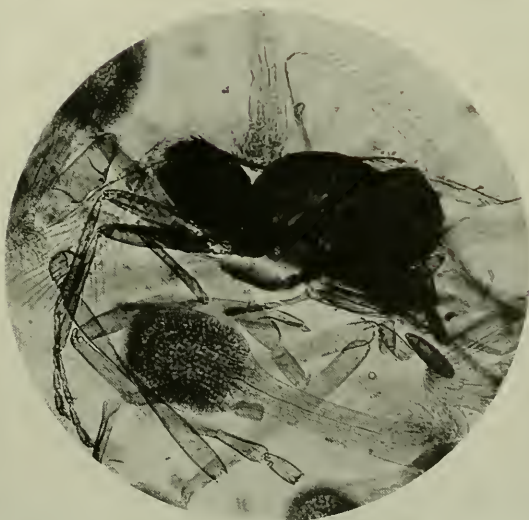
Cut cross (transverse) sections, keeping both stem and blade wet with water, and allow the slices to fall into a watch glass of

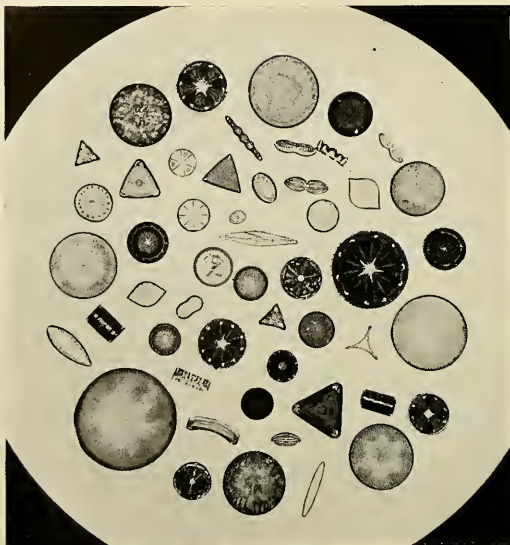
Below is pictured the head of a dog flea. Careful examination of this photomicrograph will bring out the comb, the vestigial eye, and the highly complicated mouthparts. The microscopic study of insects reveals many details that could hardly be imagined without the aid of the lens



Above is shown a protozoan struggle as it appears under the microscope. These creatures are all protozoans, but the two dark figures (Didinium) are attacking Paramecium. Didinium punctures its prey and sucks out its protoplasm

A microscopic view of a bit of an insectivorous plant. This highly magnified view shows a portion of the leaf of sundew, together with a captured insect, which, in this case, is a thrips

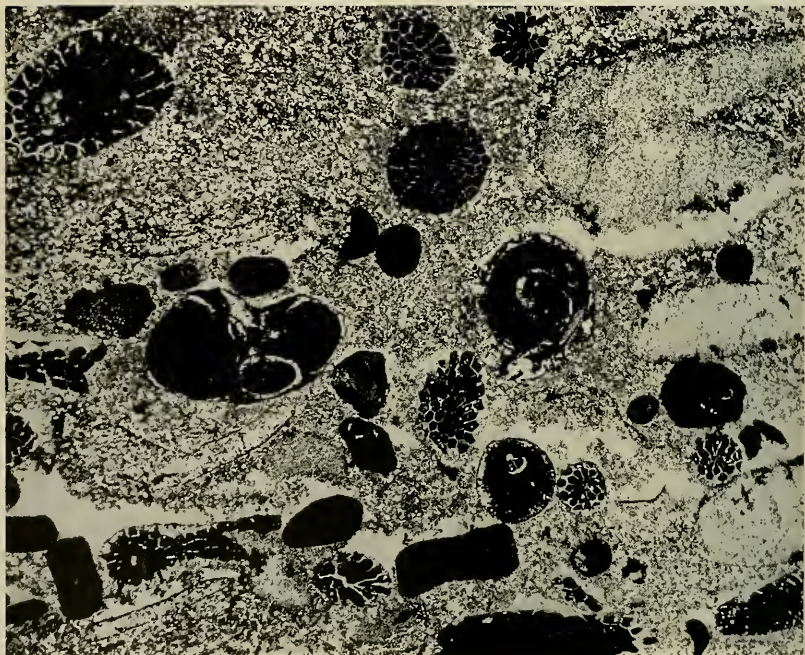




This photomicrograph shows an arranged circle of fifty different species of diatoms. These are one-celled plants that secrete glass boxes to be used as houses in which to live. Among them there is immense variety in size, form, sculpturing, and color. They are a favorite group among amateur microscopists

*Photos by
Bausch & Lomb*

The thin rock section pictured below shows limestone containing many fossil shells of minute protozoan animals — the Foraminifera, of which some limestones are largely composed



water as they are cut. Mount one of your best and thinnest sections on a slide, treat with 10 per cent commercial formalin for ten minutes, rinse in water, stain in safranin for an hour, rinse quickly in 95 per cent alcohol, counterstain with light green for thirty seconds, again rinse in 95 per cent alcohol, clear in aniline oil for ten minutes, and mount in balsam.

Here will be a most interesting picture of the heart of the plant system. Those heavy-walled tubes that take the red stain of safranin constitute the woody part of the stem and conduct water upward from root to leaf. Minerals leached out of the soil will travel in dissolved form in this ascending water. Thinner-walled tubes which have stained green are the sieve tubes and carry food materials downward from leaf to stem and root, feeding the non-productive portions of the plant. Slides like this project brilliantly and photograph well. Practice is essential for the making of good stained sections, but the method is not difficult.

BLOOD

The next time someone in your establishment cuts his finger, take a clean slide and cover and catch a drop of his blood, covering it immediately and sealing around the edges with vaseline to keep out air. Such a slide will remain in condition for study during an hour or more.

Permanent mounts are made in the form of cover glass films, requiring a bit of dexterity. A drop of blood is caught on one cover glass, a second glass is immediately placed on top of the first, and the two are then drawn apart by slipping sideways, without pressure. Speed is an important essential, it being necessary to prepare a thin, evenly distributed film on the inner surface of each glass with the greatest rapidity to prevent post mortem changes.

Each film is then exposed to the air, drying being so instantaneous that all of the blood cells are fixed in a natural state. Place a blank slide across a small, shallow, glass vessel, which here serves as a miniature sink or waste jar; then lay one of the cover glass films face up on this slide, which acts as a table to support the cover glass. With a pipette, medicine-dropper type,

put two drops of Wright's stain on the film and time it to remain one minute. Next add two drops of distilled water to the stain already on the film, and let stand for three minutes. Now drain off this mixture of stain and water and replace with water alone. Mount the slide on the stage of a microscope, so that the process of bleaching which now ensues may be watched and checked. When the red corpuscles have a salmon-red color, drain off the water and blot the film gently with a piece of filter paper. Expose to air for five minutes longer to insure thorough drying, then mount, film side down, in a drop of balsam on a clean slide.

WHAT THE MICROSCOPE REVEALS

Red corpuscles should be everywhere present in great abundance. They are small, circular discs; cells that during development have lost their nuclei in order to function more effectively as flexible bags containing the fluid pigment, hæmoglobin. This substance combines with oxygen in the thin-walled capillaries of the lungs and transports the life-giving gas to all parts of the body. The remarkable chemical interchanges which take place continually in each of the millions of these red cells literally provide for us the breath of life.

Scattered through the field are occasional blue cells of various types, the white corpuscles. The cell substance takes a blue stain, the prominent nuclei a purplish one. Some of them have minute granules that take a bright red color. These corpuscles are the policemen of the body. They are able to leave the blood vessels, pushing through the walls and migrating out into the tissues to fight infection. Like an amœba, they can produce pseudopodia and engulf bacteria or foreign substances and thus, if their fight is a successful one, rid us of invading destroyers.

Yes, microscopy is indeed a revealing and engaging hobby. Study what you will, — soils, textiles, plants, animals, minerals, chemical crystals, industrial products, or criminological evidence, — the microscope is man's chief tool in this age of science. To know nothing of this marvelous instrument is to be out of step with the times.

Down Among the Smokies

A visit to an American mountain range that possesses a distinctive charm

BY F. R. DICKINSON

President, Chicago Academy of Sciences

IF YOU like our western mountains and would also like the Great Smokies, you must learn to substitute for the lanky cowboy the gaunt and hospitable mountaineer; for the bucking bronco, the kicking mule; for sagebrush, the rhododendron and laurel; for sudden dust storms, equally sudden rainstorms; and for the six-gun, the long squirrel rifle. Overalls take the place of chaps, and coons of coyotes. It all sounds pretty tame, perhaps, yet there is something about that country —

First for a few facts. The new Great Smoky Mountains National Park contains more than 400,000 acres of mountains, valleys, forests, and streams, part in North Carolina and part in Tennessee. From Knoxville, near the western end of the Park, a straight line about 650 miles long will reach New York; others, about 500 miles long, will reach Philadelphia, Buffalo, and Chicago; and still others, about 375 miles long, will reach Washington, Pittsburgh, Cleveland, Toledo, St. Louis, and Memphis. In other words, only one or two days of easy driving lie between this natural playground and most of the larger cities of the East and Middle West. From the Southeast, of course, it is even more readily accessible. Authority for its establishment was extended by Congress in 1926, with the proviso that no general development could be undertaken by the National Park Service until a minimum of 427,000 acres, within designated boundaries, had been acquired. Through the generosity of the states of North Carolina and Tennessee, of certain private citizens of those States, and of the Laura Spelman Rockefeller Memorial, the development of the area is now assured.

Here, according to official account, one can see the largest virgin hardwood forest

and the largest virgin forest of red spruce in the United States. Nowhere else in the world, according to the same government bulletin, is there in an equal area such a variety of plant life, included in which are 152 varieties of trees. Among the larger species are hemlock, buckeye, chestnut, and tulip tree. Specimens of the last named, having a diameter of ten feet and a height of 190 feet, have been found.

Some years ago a blight destroyed many of the great chestnut trees, but with a warm climate and a rainfall said to approach one hundred inches a year, root sprouts are springing up with amazing rapidity. This lavish supply of moisture no doubt accounts in part for the beauty of these forests at all seasons; for in winter it helps to coat the evergreens with a filigree of frost, in spring and summer it supplies a verdancy to the new growth not seen in northern woods; and in fall, it may explain why the leaves, full of sap and vigorous to the end, flame at the first touch of frost into an incredible brilliance of yellow, gold, and crimson. Possibly the humidity due to rainfall may have something to do with the startling blueness of these mountains, even when in full sunlight and at no great distance. This seems not to be caused by ordinary haze, — distant objects are generally clear, — but is a pure, translucent color deepening in tone as the landscape recedes, and adding immensely to the charm of long views. Though at times the higher ridges are blurred or hidden by mists such as rise in any mountainous region, it is these blue or purplish distances which must have given the mountains their name.

Not less interesting than the big timber are the shrubs and wild flowers, which have drawn to this region botanists from many parts of the world. Spring opens early and even in midwinter the rhododendron and mountain laurel are green against the snow.



Ewing Galloway

Smoky Mountain homes often cling to a hillside amid the ever encroaching forest

Rich valley soils produce vegetables in quantity which tide the mountaineer over the winter



H. Armstrong Roberts



*Not all Smoky streams
are bridged; some are
mere fords, hardly pass-
able when the water is
high*



Ewing Galloway

*Smoky Mountain resi-
dents are of pure Amer-
ican stock, but their
living conditions are
practically the most
primitive in the nation.
The picture below shows
a typical mountaineer's
cabin. These dwellings
are often miles apart,
with rough mountain
trails between houses*



Ewing Galloway

By May or June they and the azaleas cover the slopes with sheets of bloom, — white, pink, rose, lemon-yellow, and red. From March to November smaller plants, both annuals and perennials, provide a pageant of flowers which for variety and profusion rival those of the Rocky Mountains. Local flower enthusiasts tell us that hepatica, bluets, violets, wood sorrel, and bloodroot, starting the procession, are followed in April by trailing arbutus, bluebells, phlox, golden ragwort, and meadow rue. A little later come iris, bleeding heart, yellow-eyed grass, silverbell, trillium, columbine, Dutchman's breeches, wild geranium, and lady's slippers. By June, daisies, spiderwort, beardtongue, and puccoon are in bloom. In July come butterfly weed, passion flower, black-eyed Susan, lilies, purple-fringed orchis, milkweed, and star grass. August brings asters, yellow-fringed orchis, turtle-head, mints, betony, St. Johnswood, cardinal flower, and monkshood. And closing the season in September, October, and November are goldenrod, iron weed, bone-set, sunflower, gentian, and coreopsis. These are the captains and lieutenants of the floral army. As privates in the ranks there are a host of less striking but no less interesting species.

ANIMAL LIFE IN THE SMOKIES

Of mammals, about fifty-four species native to the region are still extant, included in that number being the wildcat, deer, and black bear. Bird life is abundant and of great variety. Both birds and mammals have recently been made the subjects of a faunal survey by field representatives of The Chicago Academy of Sciences, E. V. and Roy V. Komarek who received the full and helpful coöperation of the park superintendent, Mr. C. Ross Eakin, and the chief ranger, Mr. Charles Dunn. The data compiled and specimens collected during a year or more of intensive work indicate that the Park area is a paradise for wild creatures. Not only are migratory birds present in large numbers in spring and autumn, but owing to the diversity of the terrain and of the food supply and the great range in elevation and hence in temperature, a surprising number of species remain as

winter, summer, or permanent residents.

Scattered in remote little valleys are clearings where mountain families live in primitive fashion, tending a few acres of corn and potatoes, raising a few hogs and chickens for home use, milking a cow or two, — almost as close to nature as the birds and animals they used to hunt. So weathered and innocent of paint are their cabins that they merge with the surroundings almost as completely as if they had grown there, no more obtruding upon the landscape than worn outcrops of rock against a hillside.

It is worthwhile to talk with these slow-spoken, soft-worded mountain people, lacking in book learning, resistant to the ways of the outer world, but steady-eyed and steady-minded, observant, thoughtful, and deeply attached to their homes. Though some have moved away since the Park took over their small holdings, many others, loath to leave the scenes of their youth, are staying on with the consent of the authorities. No longer allowed to hunt for a living, they find seasonable employment on trails and roads and continue to raise garden truck and children much as they have always done.

In names and features their Anglo-Saxon origin is often apparent. Their forbears drifted into these coves on the eddies set in motion by the opening of the West, found life to their liking, and watched their more restless contemporaries move on to broader fields. Inevitably since those early days, there has been much intermarriage between related families, but to the casual observer there is little physical evidence of harmful results. It is said that in one school, now abandoned, eighty out of a hundred pupils bore the same name, yet such information as is obtainable points to no higher percentage of feeble-mindedness than might be found in any country community.

Feuds exist, though apparently not as commonly or virulently as in some of the other mountainous parts of the Southeast. To strangers, hospitality is as unstinted as it is simple. If nothing more elaborate is at hand, a cup of spring water is offered to the passer-by with a cordial invitation to sit awhile and pass the time of day. Among



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Dome Cascades

Roaring Fork Creek, on Mount Le Conte, traverses some of the most beautiful sections of the great Eastern National Park of the United States. Visitors to the region marvel at the diversity of scenery along the way



© J. E. Thompson

A sight never to be forgotten — the Smokies as they appear in winter from the top of Mount Le Conte



In early spring the Smoky Chimney Peaks are a mass of flowering rhododendron. At the left is shown one of the highest of the Chimney Peaks

Ewing Galloway



© J. E. Thompson

Long mountains, with masterful, yet graceful slopes stretch to the horizon wherever one may turn



Hikers on the trails of Mount Le Conte never fail to pause beside Rainbow Falls, where constant moisture produces a luxuriant plant growth

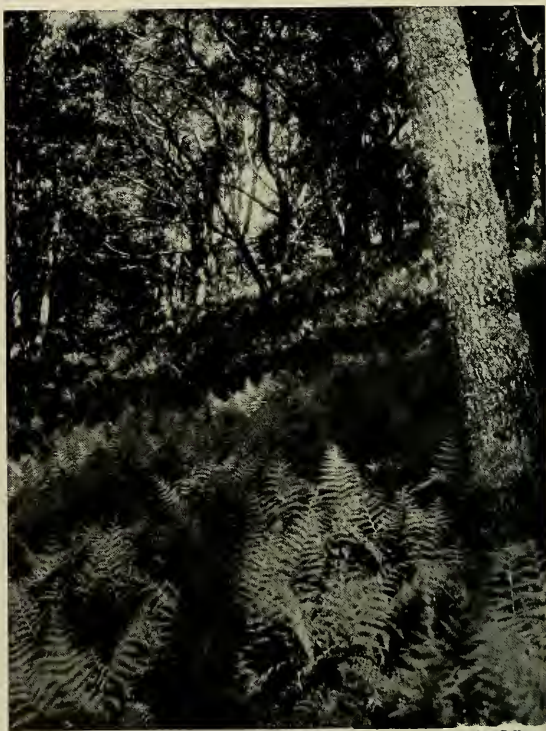
Ewing Galloway



© J. E. Thompson

*Another view on Roaring
Fork Creek. Cascades are
frequent as one travels on
Smoky trails*

*Upon the mountain slopes
the rainfall is heavy and
the forest undergrowth is
rich in variety and inter-
est. Tall, stately ferns de-
light the eye*



Ewing Galloway

the exceptionally prosperous, the standard of living is higher than might be expected. In one farm home, of blessed memory, fourteen kinds of food, not counting jelly and preserves, were set before the bewildered traveler. Only the mountain habit of putting everything on the table at once enabled him to grasp the situation in time, plan a campaign, and eat his way to a successful finish.

In most localities the cabins are too far apart to permit of much sociability during the week, but on Saturday and Sunday a good deal of visiting goes on, often to the accompaniment of guitar and banjo. Of the songs, many are old, and most of the favorites are plaintive — the musical expression of a people who do not try to cover the essential sadness of human experience with a veneer of frivolity. Among the ones most favored seem to be "Twenty-one Years," "Sorghum Molasses," "The Fifty-cent Piece," "The Faded Picture on the Wall," "The Old Pine Tree," and "Bring Back My Blue-eyed Boy to Me."

In some communities the sparseness of the population makes regular church-going impossible, but each year, usually in May, local meeting-houses, which may have been closed most of the year, are opened for memorial services attended by many former residents of the neighborhood who have moved away long since. For days beforehand the women and girls busy themselves in making paper flowers, less beautiful, no doubt, than the wild ones to be had for the picking, but a surer proof of remembrance for the dead. After a brief and sometimes extempore service in the church, the congregation moves to the graveyard, where families join in paying a floral tribute to those members who have gone ahead. On these occasions it is interesting to note the signs of the times among the young. Girls who dress drably enough on working days are as fresh and graceful in Sunday garb as their town and village cousins.

Though some of the old customs are dying out, one finds here and there a pleasant reminder of earlier and simpler days. Corn is still ground between upper and nether millstones, turned by a ponderous, overshot wheel, to which water from up-

stream slides down through a leaky flume. The mule drags a homemade plow all week and then carries its owner a-visiting on Sunday. This uncertain quadruped, indeed, figures in one of the mountain songs which in its refrain condenses into one line the mountaineer's philosophy of independence:

He rides a super-six,
I ride a mule that kicks,
Nobody's business if I do!

Everywhere in these hills are streams. In the higher reaches where fishermen have not waded them too faithfully, they are well stocked with trout; and in the quieter waters of the valley bottoms old men who have time to sit in the shade through long summer days keep their family larders supplied with bass. Whether or not one cares to fish, there is no better way to enjoy a ramble than to trace one of the smaller brooks from mouth to source. Often in its lower course you will find it accompanied by a back-country road winding upward, now hugging a steep bank overgrown with flowering shrubs, now scrambling up a rocky gully, now meandering through an open cove where every rotting fence post is festooned with honeysuckle.

If you have been well advised, you will pack a light raincoat on an all day trip, for though at morning the sky is usually serene, by noon masses of cloud may be wheeling through the gaps and hanging ominously over the summits. By two o'clock you are in the midst of a deluge, or if luck is with you, are merely watching one a mile away on the other side of the valley. Half an hour later, the sky is clear, every spray of laurel and azalea gleams in the sun and the air is soft with the odor of damp loam and spring flowers.

As you take the easy downward path toward home you wonder whether the people who live in that tumble-down cabin near the trail understand better than most of us what Shakespeare meant when he wrote:

And this our life, exempt from public haunt,
Finds tongues in trees, books in the running brooks,
Sermons in stones and good in everything.

The next time you get restless, look up the road map and see how long it would take you to drive to the Smokies.

A Unicorn's Horn

The horn of an Indian rhinoceros now in the American Museum which, in 1590, was presented as a unicorn's horn to Pope Gregory XIII

BY DOROTHY L. EDWARDS

IF A physician of today were to recommend to his ailing patient a dose of pulverized sea serpent's tooth, the prescription would doubtless be considered a preposterous and impossible one. It would, however, be entirely comparable to one that was very much in vogue among the best people several hundred years ago.

The unicorn for many years held a position in the minds (and hearts) of men similar to that of the sea serpent. Like that popular but elusive monster of today, it was from time to time seen and described by certain favored mortals, and occasionally parts of its anatomy were discovered, but closer to one than that, man was not destined to come.

The one feature consistent in unicorns was a horn growing from the center of their foreheads, from which, of course, their name was derived. There were, however, variations concerning the style of this horn. Originally the spiral and comparatively slender tusk of the narwhal was the inspiration for the unicorn, but the more cumbersome horn of a rhinoceros at times was also claimed to have come from the elusive beast.

There was a practical side to discovering a horn that could pass as having come from a unicorn, for in the Middle Ages a doctor could prescribe nothing more potent, nor more expensive, than a piece of ground unicorn horn. If the patient died despite, or because of, this admirable remedy, alibis were doubtless easy to produce in protecting its reputation. There was one thing that kept its use from becoming common — the price, which ranged anywhere from \$12,000 to \$150,000.

A gift of great value, therefore, was the

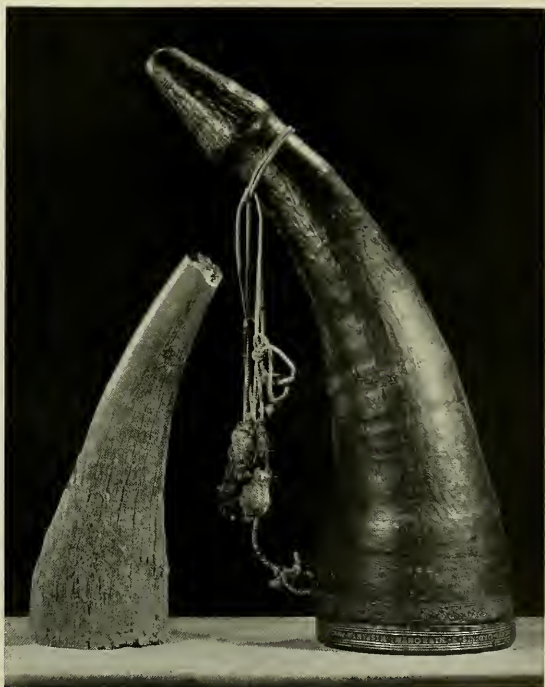
"unicorn" horn presented to Pope Gregory XIII by the Prior and Brothers of the Monastery of St. Mary Guadalupe, Spain, in 1590. In reality it was the horn of an Indian rhinoceros which, enclosed in a handsome leather case, was sent to Pope Gregory, who at the time was known to be in feeble health. How the horn of an Asiatic mammal fell into the hands of the Spanish monks is a story which gives the imagination fascinating material with which to play. At any rate there is no doubt that both the monks and Pope Gregory valued it highly. During the last stages of Gregory's illness, the tip of the horn was powdered and administered to him, but to no avail. If for no other reason, however, the gift was worth while, because of its case, which is of fine leather, embossed in gold, and carrying on the cover an elaborate inscription from its donors. Today, despite the tiny worm holes that mar the original smoothness of its surface, it is still a thing of beauty.

It is interesting to realize that in China, even now, the horn of the Indian rhinoceros, under its true name, reputedly has great medicinal value. In fact the species represented by this ancient horn is today practically extinct because of its popularity for this purpose.

In 1909 Pope Gregory's "unicorn" horn was brought to light and offered for sale, at which time it was purchased by Dr. L. Pollak of Rome. Some time later it was obtained from him by John L. Marshall who, in turn, presented it to the American Museum of Natural History. Here, after its several hundred years of adventure, the rhinoceros horn may now be seen in the Hall of South Asiatic Mammals, once again in the environment to which it belonged before circumstances cast over it the glamorous appellation of "unicorn."



The ancient horn of an Indian rhinoceros, which came to be known as a unicorn's horn, being examined at the American Museum of Natural History, where it is now on display. In the background is a mounted African rhinoceros



The unicorn's horn that once belonged to Pope Gregory XIII, and the handsome leather case in which it was presented to him by the Prior and Brothers of the Monastery of St. Mary of Guadalupe, Spain, in 1590. The missing tip of the horn was administered to Pope Gregory during his last illness

Science in the Field and in the Laboratory

American Museum Activities, Expeditions, Education, Meetings of Societies, and New Members

Edited by A. KATHERINE BERGER

Morden Expedition for Hawaiian Fishes

An almost endless number and diversity of species of marine fishes occur about the reefs and coastal waters of the Hawaiian Islands. Many of them are of bright and bizarre colors, and do not fail to interest visitors to the aquarium in Honolulu. Color plates published by the United States Bureau of Fisheries have made Hawaiian fishes known to a wider public. The present winter Mr. William J. Morden, a field associate of the American Museum, will be in the Hawaiian Islands three months to obtain material there for the department of fishes of considerable importance in two research problems this department has in hand, the changes with age in fish known as crevallys as bearing on the relationship of the different species, and the number and relationships of different flying-fishes in the Pacific. — J. T. N.

Scientific Study in Polynesia

Christmas greetings to colleagues in the American Museum started on their way from Tahiti on November 22 from Dr. James P. Chapin, who, with Mr. Templeton Crocker, Dr. H. L. Shapiro, and Mr. F. L. Jaques sailed on September 15 from San Francisco to collect scientific material from southeastern Polynesia. At the time of writing, the expedition had worked in the Marquesas and Tuomotus, completing about one half of the material necessary for the bird groups which are planned for the American Museum. The party expected to sail eastward again toward Easter Island and Valparaiso.

Sage West China Expedition

A letter from Mr. T. Donald Carter of the department of mammalogy at the American Museum, dated November 12, 1934, Cheng Wei, Szechwan, says that the expedition was to move on to Maomogou in a few days. This region is supposed to be good hunting ground for takin, and both the panda and the golden monkey are found there. This is to be the expedition's last permanent camp, for they are planning to reach Chengtu on their return by December 15. They now have 1396 mammals and 233 birds.

* * *

As this note is being prepared for press, word comes that on December 11 a cable was received by

Mr. Sage's father that the expedition had secured a panda.

The American Museum-Vernay-Hopwood-Chindwin Expedition

Mr. Harry C. Raven, associate curator in comparative and human anatomy at the American Museum, arrived at Rangoon January 5, where he was joined by Mr. Arthur S. Vernay, who flew from London. The expedition left several days later for Mandalay on its way to Mogaung and Chindwin River.

Nova Herculis

One of the most interesting astronomical events in recent years is the flaring-up of the so-called "new star," Nova Herculis 1934. Occasionally it happens that a faint star, for some reason not well understood by astronomers, suddenly increases very rapidly in magnitude or brightness, and it is then called a "nova" or a "new star." Nova Herculis was formerly a star of 15th magnitude, too faint for the naked eye and visible only in large telescopes. About Christmas-time it had increased to first magnitude, and had become one of the twelve brightest stars in the sky. The explosion which astronomers believe was the cause of this increase in brightness of Nova Herculis occurred some 1500 years ago, and the light of this disturbance is just reaching us today, as this star is distant from us by approximately 1500 light-years. The nova can be seen in the morning sky between the bright star Vega, in the constellation The Lyre, and the head of the Dragon. It is about eight degrees from Vega, to the left and a little above this star. Nova Herculis is probably being carefully observed by more astronomers at the same time than any other star in history, since this is the first brilliant nova which has occurred since certain very important developments in astronomical apparatus.

Astronomical Address

At the Annual Meeting of the American Association for the Advancement of Science held in Pittsburgh at the end of December, Dr. Clyde Fisher spoke before the Astronomical Section of the group, on the subject, "The Hayden Planetarium." The Astronomical Section met on this occasion in the Allegheny Observatory.

Dr. Fisher attended the meeting of the American

Astronomical Society which was held in Philadelphia at the Fels Planetarium from December 27th to 29th inclusive. Miss Dorothy Bennett and Miss Marian Lockwood also attended these meetings.

The Hayden Planetarium

Work on the Hayden Planetarium is progressing most satisfactorily, and present conditions seem to indicate that the building will be open for demonstration to the public early in the summer. All the outside brick-work is completed, and it is expected that within about six weeks the stainless-steel inner dome will be installed. This dome is to be perforated with tiny holes. Passing through these holes, sounds are absorbed by a layer of mineral cork in the space between the steel dome and the concrete dome which lies just outside this. This prevents the difficulty of echos—a difficulty which is a serious one in a room with a hemispherical dome.

Amateur Astronomers Association

During February the Amateur Astronomers Association holds two meetings on its usual Wednesday nights. On February 6 Dr. R. E. Lee will speak on "This Wobbling World," and on February 20 Mr. Stansbury Hagar will speak on "Constellations of the Mayas and the Mexicans." Anyone interested in attending these lectures is most cordially invited to do so, as they are free to the public. Those wishing further information concerning the various activities of the Association may write to Miss Marian Lockwood, Secretary, Amateur Astronomers Association, American Museum of Natural History.

Astronomy Broadcasts

The Amateur Astronomers Association is on the air again, on Tuesday afternoons from 3:30 to 3:45, over Station WOR. On February 5 Mr. Charles A. Federer, Jr., will speak on "The Radiation of the Stars"; on February 12 Dr. Clyde Fisher will speak on "The Progress of the Hayden Planetarium"; and on February 19 and 26 Miss Marian Lockwood and Mr. Arthur Draper will present dramatic sketches describing imaginary journeys to the moon and neighboring planets.

Spring Program, American Museum Educational Lectures

EXCLUSIVELY FOR MEMBERS

Arrangements have been made for three courses of lectures which are exclusively for members of the Museum and their personal guests, namely:

1. Member's course of four lectures in February and March on alternate Thursday evenings at 8:15 P.M. The lectures for February are:

- February 14 "Tiger Hunting in the Xarayes Marshes," by Sacha Siemel.
- February 28 "Wings Over Africa," by Martin and Osa Johnson.

2. Nature stories for children of members, on alternate Saturday mornings at 10:30 A.M., begin-

ning February 16, when William L. Finley will speak on "Birds, Berge, and Kodiak Bears."

3. Know your Museum Series. "Jade and the Drummond Collection." This course will be conducted by Herbert P. Whitlock, curator of minerals and gems, and will constitute an extensive study of the Drummond Collection of carved jade, amber, and ivory. The first two of these talks and walks will take place at 8:15 P.M. o'clock on March 5 and 19 respectively.

COÖPERATION WITH COLLEGES AND UNIVERSITIES

The latest development in the coöperation with the colleges and universities of New York City is an arrangement for conducting two courses by member of the American Museum staff exclusively for Hunter College, for which the lecturer will receive the customary fee paid by the College. The courses include one on "General Astronomy," conducted by Dr. Clyde Fisher, and one on "Physiology and Health," conducted by Dr. G. K. Nohle. The former course will be given at Hunter College, the latter at the American Museum.

These courses are being undertaken at the request of Hunter College, through Prof. E. B. Cohen, director of evening and extension sessions.

In addition to the above-mentioned courses, the following are being given in coöperation with Hunter College and the College of the City of New York, for each of which college credit is allowed; also alertness credit is granted by the Board of Education. Admission to these courses is by registration through either Hunter College or the College of the City of New York. They are:

- "Nature Study for City Teachers," by Farida A. Wiley.
- "The Museum in Elementary Social Studies," by Grace Fisher Ramsey.
- "Mechanics of Visual Instruction," by L. Wales Holden.

For programs and educational requirements of the above courses, apply to the Department of Education of the American Museum.

Dr. Clyde Fisher will continue his course in "Astronomy for Teachers," given in coöperation with New York University.

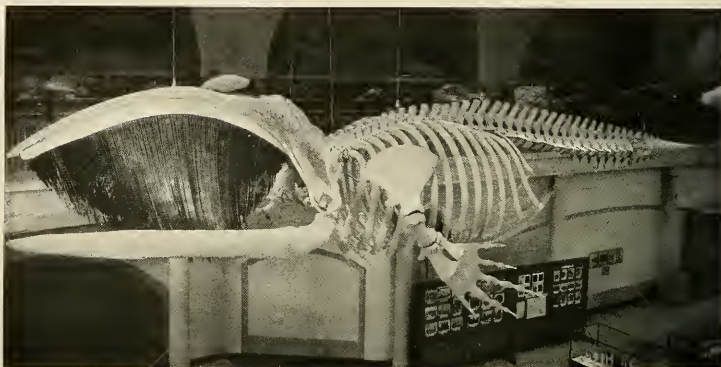
FOR ELEMENTARY AND HIGH SCHOOL STUDENTS

The usual courses for elementary school students are being continued on Mondays, Wednesdays, and Fridays, at 10:30 A.M., and the Friday lecture is repeated at 1:30 P.M.

The department of education will also continue the free lectures on biologic science for high school and college students, during the spring, on Tuesdays at 3:40 P.M. beginning March 5.

EXHIBITION HALL TALKS

The series of exhibition hall talks will be continued, including the "three special activities program" in finger painting, geography crafts, and miniature



From Ocean to Museum Hall

group making. All these classes are given by appointment only.

OTHER LECTURES FOR ADULTS

Curator Whitlock will give a course on "The Cultural Appreciation of Gems," on Saturday afternoons at 4 P.M. during April. Announcement of the subjects will appear in the March issue of this magazine.

A series of five walks and talks on "Primitive Cultures of North and South America" will be given by Georgine Mastin on Saturdays, at 2 P.M., beginning February 9.

The Museum is continuing the cooperation with the Adult Students Association, and a concert program will be presented at 3:30 P.M. on February 2 by the Bronx Symphony Orchestra of the Emergency Relief Bureau Works Division.

The third and final lecture of the series arranged for the Evening Elementary School Students Association will be given by Dr. Roy Waldo Miner, on February 8 at 8:15 P.M. It is entitled "Exploring Beneath the Sea."

FREE GUIDING SERVICE

The free guiding service of general tours of the Museum, conducted by Dr. William Lord Smith, will be continued on Wednesdays, Fridays, and Saturdays, at 11 A.M. and 3 P.M.

RADIO PROGRAMS

The radio programs given by John R. Saunders of the Museum over WNYC at 5 P.M. on Thursdays will also be continued, with tours of the halls on the following Saturdays at 3 P.M.

The fifty-four-foot long skeleton of an Atlantic right whale just placed on exhibition in the Hall of Ocean Life at the American Museum

ACTIVITIES FOR CHILDREN

The Junior Astronomy Club meets the first and third Saturdays at 8 P.M.

The Thoreau Nature Club meets on alternate Saturdays at 2:30 P.M.

Free indoor nature trails for several Museum Halls are available to children.

New Whale Exhibit

After a period of a quarter of a century spent in the storerooms and preparation department of the American Museum of Natural History, a whale that created nation-wide attention at the time of its capture in 1907 has been placed on view in the Hall of Ocean Life at the American Museum. The skeleton, which is that of an Atlantic right whale, is the largest of its kind that has ever been scientifically recorded. One of the unique features of the exhibit is that the baleen or whalebone is mounted in the skeleton. This baleen is a flexible, sieve-like mechanism that is fastened to the whale's upper jaw. Each plate is about 6 inches wide and almost 6 feet long.

The whale was caught off Amagansett, Long Island, on Washington's Birthday, 1907, by a whale boat commanded by Capt. Josh Edwards, famous whaler and probably the last remaining member of the sturdy seamen who, from 1640 to about 1918, engaged in small boat whaling off the eastern end of Long Island.

The whale is historic, too, in that it was the objective of the first expedition of two men who have since become famed explorers, Dr. Roy Chapman Andrews and Dr. James L. Clark. Working waist-deep in icy ocean water, pounded by the surf and slashed by knife-sharp winds, Andrews and Clark labored two solid weeks in near zero temperature to

get the bones out. They came within a hair's breadth of losing one of the most valuable parts of the skeleton, namely the whale's hind legs — or what is left of them after 70,000,000 years of disuse.

Peruvian Mammals

The department of mammalogy of the American Museum has recently received from Dr. Harvey Bassler a very valuable and interesting collection of mammals, most of which were taken in the region about Iquitos, Eastern Peru. Doctor Bassler has resided in that region for a number of years, and in addition to the results of his major interest, which is herpetology, he found time to bring together the mammals referred to. Among these may be mentioned especially a number of specimens of the rare bush dog, genus *Ichtyon*, and another dog which hitherto has been recorded only from the eastern foothills of the Peruvian Andes, namely *Canis microtus*.

For a considerable number of years Doctor Bassler maintained his own zoological garden at Iquitos and a certain proportion of the animals donated to the Museum comes from that source. The collection is especially rich in monkeys and squirrels.

It is expected that Doctor Bassler's collection will aid very materially in settling the status of many Eastern Amazonian species and will supplement the large collections of mammals upon which the department of mammalogy is at present working.

— G. H. H. TATE

The Morgan Gem Collection

Following a long established custom, the department of minerals and gems, of the American Museum, early in January distributed the contents of the "gem accession case," containing the important pieces acquired during 1934, in the permanent installation of the Morgan Gem Collection. During the year so much has been said of the supremely important gift to the department of the Drummond Collection, that the readers of NATURAL HISTORY are in danger of overlooking the fact that the world-famous Morgan Gem Collection is growing constantly, consistently, year by year; and the department takes this occasion to express its appreciation of the generosity of its many friends who have made this growth possible by their gifts. From the magnificent opals of the Lilius A. Betts bequest to the admirably carved Buddha in tiger's eye, the gift of Mrs. Henry Morgenthau, the year's accessions show splendid gains in notable specimens.

It is the hope of the department that the 1935 accession case, now all but empty, will presently equal or surpass in the splendor of its contents that of 1934.

Honors

On January 15, 1934, the Asiatic Society of Bengal celebrated the 150th anniversary of its founding

in a special Jubilee Celebration Meeting. Following a precedent of its Centenary Meeting, the Society elected to membership a group of outstanding persons to a class designated as Special Anniversary Honorary Members. At the Centenary Meeting in 1884 six distinguished persons were thus honored, among them Ernst Haeckel, and at the Jubilee Celebration Meeting last January twelve prominent men of affairs were signally noticed. In the list it is gratifying to find the name of Henry Fairfield Osborn included by the Society as an "expression of our greatest respect for your person, attainments and activities." Other scientists elected to membership were: Ernest Rutherford; Albert Einstein; A. Lacroix; and Sven Hedin.

At its annual meeting in Pittsburgh the American Association for the Advancement of Science elected Mr. N. C. Nelson chairman of Section H (anthropology), and vice-president of the A.A.A.A.

Rotifer Jaws

In the laboratory of the department of living invertebrates of the American Museum, Mr. Herman O. Mueller has just completed seven new models of rotifer jaws and a new model of the rotifer *Epiphanes senta*, for exhibition in the Rotifer Alcove of the Darwin Hall. Dr. George H. Childs is at work on a greatly enlarged anatomical model of *Amphioxus*, an exhibit which is in great demand by high schools and colleges.



Throat jaws of a rotifer, enlarged 6000 diameters. With these the rotifer tears to pieces the still tinier animals which form its food

Lindbergh Collection of Spores in Arctic

Collections of micro-organisms which Col. Charles A. Lindbergh made on his flight through the Arctic areas in the summer of 1933, have confirmed previous work in the U. S. Department of Agriculture which indicated that pathological organisms such as those causing plant diseases may be carried long distances — even from continent to continent — by air currents.

Fred C. Meier of the Department has been studying air-borne organisms for several years — particularly those that drive northward over the plains each year to spread rust in the wheat fields. Mr. Meier interested Colonel Lindbergh in making this contribution to the scientific work of the Department, and together they worked out new and improved apparatus for taking samples of the microflora of the Arctic air.

Colonel Lindbergh devised a spore trap which he called "the skyhook," a light, strong contrivance, easy to operate, and well adapted to protecting the sterile glass slides from contamination except for the time they were exposed. Mr. Meier prepared the slides and has examined and photographed them.

In his flights between the American mainland and Denmark, by way of Greenland and Iceland, Colonel Lindbergh exposed 26 slides and returned them with field notes and free-hand maps indicating exactly where and for how long, and under what conditions each slide had been exposed. Mr. Meier has taken care of the preservation of the slides; he has been able to identify the genus and in some cases the species of many of the objects trapped in the petroleum jelly which covered the slides. More complete identifications will in many cases have to await the assistance of botanists familiar with the characteristics which identify various kinds of pollen, and of scientific workers who are specialists in different groups of fungi, mosses, lichens. On one slide, exposed far north of the Arctic Circle, Mr. Meier was able to discover under the microscope more than 40 different types of objects in a space five centimeters square. This was on a slide exposed 3000 feet above sea level along the northeastern coast of Greenland.

Mr. Meier and other Department of Agriculture workers, assisted by Army, Navy, and Coast Guard flyers, have done considerable aerial work in trapping spores and other micro-organisms, but this has been over land and in places where it was to be expected that the catch would be abundant. "This Lindbergh collection," says Meier, "is the first of its kind to give concrete evidence of the part played by air currents in the distribution of fungi between northern lands." He points out the possibility that a single living spore which is transferred by the air currents and dropped in a spot favorable for reproduction might create a center for rapid spread of infection.

The Hempstead, Long Island, Skeleton

Master Edward Gorman, while sliding down a sandbank in a vacant lot in Hempstead a few days after Christmas with several companions, had his fun spoiled by a protuberance in the slide, which appeared as a result of the boys' own erosive tactics. The protuberance turned out to be a human skull in a strange iron mask. Police, on excavating, found the skeleton of a person who had been buried tightly trussed in riveted iron hands resembling barrel hooping. The mask around the head was composed of four heavier bars of iron arising from a heavy collar about the neck and joining in a large eye bolt over the crown of the head. To this was attached a heavy eye pin, somewhat longer than a railroad spike, and obviously intended to suspend the whole grisly object from some wooden construction.

Though it was dubbed a "torture cage" by some, the historical authorities agreed that the find represented an example of "hanging in chains" or "gibbeting." The following quotation from the *Encyclopedia Britannica* describes this adequately: "Formerly in the worst cases of murder it was customary after execution to hang the criminal's body in chains near the scene of his crime. This was known as 'gibbeting.'" Though not part of any legal sentence of execution until 1752, it was nevertheless practised in the Seventeenth Century upon the dead body of the culprit as an added indignity. That the man in this case was already dead before he was encased in iron is made the more probable because it is difficult to see how a living person could have been so harnessed without killing him in the process.

One antiquary suggested that the Hempstead skeleton was that of a pirate come to justice. Another cited the case of a British soldier who, in 1782, entered the house of a Mr. Hedger at night and was shot to death by the master of the house for his trouble, his body being hanged in chains on Hempstead Plains. However, the skeleton itself does not reveal the cause of death. A hole in the side of the head and another in the face are almost certainly post-mortem injuries.

Through the kindness of Inspector Harold R. King of Nassau County the skeleton has been turned over to the American Museum of Natural History, and is now on exhibit in its iron shroud at the main entrance.

As to the individual himself, the whole skeleton, by its robustness, as well as by details of the skull and the pelvis, shows that he was a man and not a woman. That he was a white man and not an Indian is shown by such points as the depressed root of the nose and the absence of great breadth across the cheek bones. That he was probably of just such a north European type as that of the English and Dutch colonists is suggested by the conformation of the brow, together with the fairly long head and face.

His stature cannot actually be measured, since too much of him has been dispersed, but the English biometrician, Karl Pearson, has constructed formulæ by which the height of an individual can be calculated from almost any of his limb bones. Of this evil doer, only the right upper arm bone remains in sufficiently good condition to be accurately measured. The application of Pearson's formula gives a height of approximately five feet and two inches. Furthermore, the skull, though not submedium in size, gives the impression of belonging to a fairly short individual. Though short themselves, the bones are heavy and rugged, showing that in spite of his inferior height, the man was stocky and muscular. His age may be taken to be about thirty, as judged from his teeth and from the degree to which the joints of the skull vault have closed. The only other items that can be added to his personal history are these: his teeth, though not perfect, gave him little trouble; on the other hand, he suffered from a bone infection in the neighborhood of the left eye which probably caused him considerable discomfort.

— W. W. HOWELLS

A Bird Sanctuary for New York City

A worthy project has been undertaken by the New York Bird and Tree Club this year, within the city of New York.

Nine acres of natural woodland on the Bronx River, between the new Thompson Memorial Rock Garden and the large Iris plantation in the New York Botanical Garden, early next spring are to be enclosed by a fence, within which birds may find shelter unmolested, and wild flowers and trees of New York will be planted and protected. Birds are to be encouraged to stay over winter by being fed. Entrance to this sanctuary will be permitted only to those people whose honorable interest in wild life is assured.

The idea of the sanctuary within the city limits, where birds and wild flowers are particularly precious, was inspired by the sanctuary created by Mrs. James Baird on the grounds of the Scarsdale Golf Club. This area, established only five years ago, when the Club threatened to cut down a magnificent stretch of natural woods, has already become a haven for many birds, who naturally appreciate this bit of forest preserved for them. The existing growth of the area has been augmented by the planting of some of the finest of the native shrubs and flowers.

The New York Bird and Tree Club, which is now sending out pleas for new memberships and for additional funds to help in constructing the fence which will mean the establishment of the new sanctuary, hopes to make this project as outstanding a piece of work as it did when it raised \$12,000 a number of years ago for the replanting of orchards which had been devastated by the war in France.

The sanctuary at the Botanical Garden is to be made a memorial to Mrs. Nathaniel Lord Britton, wife of the founder and former director of the institution and herself an ardent worker for the preservation of wild life. It has been suggested that sections of the fence be dedicated as memorials to others.

Mrs. William Wallace Nichols of Scarsdale is chairman of the sanctuary.

Eventually, the club aims to establish arboretums in other states, beginning with New Jersey, where Mrs. Thomas A. Edison is to be the chairman. But the immediate endeavor of the 200 members is to raise funds for the New York City sanctuary at The New York Botanical Garden in Bronx Park. The Garden itself is offering all possible support and co-operation for this project. — E. D. MERRILL, Director, N. Y. Botanical Garden.

Recently Elected Members of The American Museum

A report from the membership department lists the following persons as having been recently elected members of the American Museum:

Life Members

Mrs. GEO. A. HELME.
Mr. CHRISTIAN R. HOLMES.

Annual Members

Meedames J. ADAM MURPHY, ESTELLA R. STEINER, CASIMIR I. STRALEM, HENRY ALFRED TODD, BARTON P. TURNBULL, NIEL A. WEATHERS, M. S. WEIL, LESTER WITTENBERG.
Misses CLAIR FREEMAN, JUNE FREEMAN, ELSIE KUPFER, THERESE THORNE.
Doctors LOUIS FRIEDMAN, ARTHUR S. LITTEN.
Messrs. MAURICE LAURIDSEN, JR., PRIOR SINCLAIR, PARKER A. STACY, L. L. STUART, W. S. STIMINGTON, NELSON S. THOMPSON, A. A. TILNEY, CLARENCE A. WARDEN, DAVID WATERBURY, THEODORE WEICKER, FREDERICK B. WELLS, GABRIEL WELLS, F. R. WHEELER.

Associate Members

Meedames MARY ATKINSON, KOMAH G. ATWATER, EDITH F. BAUBLE, EVA P. BENNETT, EMILIA F. BRADFORD, ALLAN C. BROWN, ANNE B. BUREANE, JOSEPH A. CAPPS, HARVEY

DENISON COWEE, WILLIAM E. CUFF, MARY CADDIRY DONOHUE CLARE DOWLER, L. E. DUNN, ELIA L. DEBBEE, W. G. ELMISIE HENRIETTA M. ELANER, MAY GRAY, C. W. HACKETT, JACE HADAR, SAMUEL P. HARRIS, JOHN SHERMAN HOBBS, WALDO HUTCHINS, JR., COLIN M. INGERSOLL, MILTON W. KING, LOUISE C. KOONS, FRED A. LEVINE, ETTA LOEWENBAUM, MARY S. LUBIN, ELLEN G. MACDOWALL, GLADYS M. MANN, MAY BENZENBERG MAYER, ANDREW B. MCCLARY, ALFRED MCCORMACK, JOHN TAYLOR MORRISON, THURLOW C. NELSON, WILLIS S. PRYOR, CLIFFORD RIDGE, GEORGIE THURSTON RIVERS, E. F. RIVINGS, RUTH ROCKER, F. PRISCILLA ALDEN SAWYER, VITALIA J. SHARPE, J. K. SMITH, MARION M. SNIFFEN, MARIE AHNIG-HITO PEARY STAFFORD, R. C. STANLEY, CAROLINE B. STEPHEN, HOOKER TALCOTT, JOHN TANNOR, S. G. TATE, SAM S. TENENBAUM, CHARLES APPLETON TERRY, W. A. TRUBEE, GLADYS M. TYLER, SOPHIA VAN DEUSEN, SAMUEL C. VAN DEUSEN, LEW WALLACE, L. E. WATERMAN, SYLVIA H. WEISS, ALEX. M. WETHERELL, A. C. ZABRISKIE.
Messes E. ABRAMSON, LOUISE ADAMSON, BLANCHE ADLER, MAE ALEXANDER, CORNELIA W. ALLEN, FRANCES BIRD, ELIZABETH F. BLACKMAN, BEATRICE BLAKESLEE, FLORENCE P. BOIS, EMMA C. BONNEY, FLORA H. BRADLEY, HARRIET BROWNELL, HELEN D. CAMPELL, JANE A. CATLIN, DOROTHY C. CHASE, EDITH C. COCK, LILLIE DAVIDSON, ELIZABETH IRENE DAY, MARIE HELEN DEACON, JANE H. DE WOLF, MARY E. DELOUPE, MARY E. DONAHUE, MARGARET M. DOTY, ANNE DUNN, ETHEL T. DYER, ELSA EEBLING, ALBERTA C. EDELL, REREKAH ELTING,

Reviews of New Books

Recent Publications for Those Interested in Nature

American Bird Biographies. By Arthur A. Allen, Ph.D., The Comstock Publishing Company, Ithaca, N. Y. Dec. 1934. 238 pp. illus.

THERE may possibly be other bird photographers who take as fine pictures as does Doctor Allen, but none secures studies that are more significant. Being an ornithologist first, Doctor Allen is not satisfied with mere portrait-snaps. His bird pictures must tell a story.

The twenty lavishly illustrated biographies contained in this handsome volume originally appeared one at a time in the School Department of *Bird-Lore*. They were written in the first person, the bird telling the story.

These are delightful in the extreme, and give highly informative and revealing material on courtship, nesting, and migration, but frankly, this reviewer feels that adults enjoy them more than children. They read the stories and love them. In this day of sophisticated youngsters who lose their faith in Santa Claus at an early age, it is perhaps unconvincing that a bird should talk and possess human thought processes. I would recommend the book unreservedly for adults — and certainly the Junior Literary Guild would not have made it their January selection were it not highly suitable for children.

The birds treated in the biographies are the screech owl, chickadee, house wren, scarlet tanager, house sparrow, herring gull, Baltimore oriole, cowbird, peregrine falcon, canvas-back duck, bluebird, kingfisher, green heron, humming bird, ruffed grouse, flicker, killdeer, redstart, robin, and goldfinch.

Those of us who are worried over the rapid decrease of our raptorial birds would like to have seen the account of the peregrine or duck hawk toned down a little. Certainly this story and especially the first paragraph does the bird no good. The duck hawk is a scarce species with a glamour and an æsthetic value that far overbalances its so-called destructive tendencies. Doctor Allen has attempted to convey this, but has not quite succeeded for we fear most people are too "practical-minded."

It is a novelty to see a publication of Doctor Allen's illustrated with pictures other than his own photographs. Ten full-page wash drawings and ten color plates by Dr. George Miksch Sutton, his colleague, supplement the stories. These are handsomely gotten up with wide gray margins somewhat in the manner of the Fuertes plates of Abyssinian birds.

This is the second of Doctor Allen's books. We hope it is but the beginning of a series of similar volumes. — Roger T. Peterson.

A Scientist in the Early Republic: Samuel Latham Mitchill, 1764-1831. By Courtney Robert Hall. Columbia University Press. 1934. 162 pp. Frontispiece.

THE name of Samuel Latham Mitchill will be found in bronze letters on the walls of Floor I of the New York State Roosevelt Memorial with those of other distinguished sons of the State of New York who were pioneers in the sciences of geology, mineralogy, and palæontology. This New York group, in which Mitchill was an honored member, was paralleled by the Philadelphia group that included the distinguished names of Franklin, Jefferson, Ritzenhouse, and Wistar.

In setting Doctor Mitchill into his proper place in American scientific history, the author evaluates his contributions without bias and vividly presents the many-faceted, hence brilliant if somewhat erratic, personality in its own perspective: the man of broad culture and personal charm in private and public contacts; the chemist guiding the great controversy of the last half of the Eighteenth Century, founding a new nomenclature, holding the chair of "chemistry and other arts" at Columbia University; the pioneer in the natural sciences — geology, mineralogy, palæontology — not merely theorizing in an age of theories, but practically applying his scientific knowledge in his country's problems (such as his fight for public health, quarantine enforcement, etc.) and his political influence in advancing science and its activities. Readers of *NATURAL HISTORY* will be particularly interested to learn that one of the societies developed in this way, the New York Lyceum, grew in its museum phase into our American Museum of Natural History.

This small volume should be welcomed by students of American science and by those who are interested in the American scene of a century and more ago, in which Samuel Latham Mitchill was so important a figure that he may today be rated as an outstanding American scientist. Mr. Hall has added to the value of the work by appending a list of learned societies to which his subject belonged and a bibliography of Mitchill's writings. The volume is attractively published by Columbia University Press. — H. F. O.

Introduction to Human Anatomy. By William K. Gregory and Marcelle Reigneu. Guide to Section I of the Hall of the Natural History of Man, illustrated. Selected references. 82 pages. The American Museum of Natural History. 1934.

MANY students of biology utilize the halls of the American Museum, and frequently students spend hours copying the details of the exhibits

into their notebooks. Various devices are at present available in the Museum for helping the students master these details, but none is more successful than the guide books to the halls. The new Hall of the Natural History of Man has proved of great interest to the general public and an invaluable aid to the students of biology. Doctor Gregory and Miss Roigneau have written a guide book which not only summarizes the data useful to the student, but presents this in such an attractive manner that the pamphlet will arrest the attention of even the most casual visitor to the Museum.

The guide book follows the arrangement in the hall closely. First, matters of general interest are considered. These include the sources of energy and the chemical engine which forms our body. Then the evolution of man and some of his most fundamental features are treated in detail. Lastly, the nervous system and its functions are described. Many photographs of the exhibits in the hall are included, greatly enhancing the value of the book as a source of reference. Gregory and Roigneau's guide book will long remain a standard text concerning human evolution.

— G. K. NOBLE.

Dynamics of Population. Social and Biological Significance of Changing Birth Rates in the United States. By Frank Lorimer and Frederick Osborn. The Macmillan Company. New York, 1934. Pp. xiii+461.

MR. FREDERICK OSBORN, research associate in anthropology, American Museum, has with Frank Lorimer, just issued an important book on the *Dynamics of Population*. The purpose of this volume is to analyze the population trends among the different national groups in the United States, revealing the differences in birth rate, death rate, etc., with a view to forecasting the relative strength of these national groups in the population of the next century. The total population of the United States is classified in various ways, as by national origins, occupations, and economic status. Also, considerable attention is given to the differences between rural and urban populations. These studies are followed by a review of the physical and mental characteristics of these groups, pointing out variations in intellectual development and social status.

The next important question considered deals with the different reproduction rates among these classes, since it is obvious that those classes having higher birth rates and greater survival rates will dominate. The results of these investigations lead the authors to conclude that, though it is yet to be proven that there are important hereditary differences in capacity, as between these classes, it does turn out that there is evidence of a sorting process by which levels in intellectual capacities are established, and that in consequence, the intelligence ratings for such classes will differ. On the other hand, there is evidence that capacities are inherited and "so a relatively slight increase in the reproduction rate of the

groups with the higher average capacity for intelligence, and a relatively slight decrease in the reproduction rate of the groups with the lower average capacity for intelligence, would very largely increase the number of individuals of high capacity, and very largely decrease the number of feeble-minded. Present trends are producing the opposite result."

The remainder of the book is given over to a consideration of the causes for the observed trends in population, the conclusion being that low rates of reproduction among the social groups at the higher levels are the chief factor. However, it appears that economic and social factors play a large rôle in determining fertility, and that the particular kind of family limitation pattern adopted by a social class is the chief determiner. Further, the claim is made that no groups with a high standard of living and with a knowledge of birth control methods can be expected to be permanently self-replacing, unless influenced by social conditions that are distinctly favorable to fertility. After this careful scientific analysis of population and related data, the authors turn to consider the possibilities of social control, suggesting that city planning, enhancing of economic security for young couples, and the development of proper social attitudes and ideals, hold out the greatest promise for such control. — CLARK WISSLER.

Through Space and Time. By Sir James Jeans. New York: Macmillan Co. 1934.

THE lay reader always welcomes a new book by Sir James Jeans, for this writer has the ability to make the story of science fascinating and clear. He is certainly an outstanding literary scientist. His latest book, *Through Space and Time*, is based on the Royal Institution Lectures of Christmas, 1933, and is composed of eight chapters under the following headings: The Earth, The Air, The Sky, The Moon, The Planets, The Sun, The Stars, and The Nebulæ.

The first chapter, that about the Earth, is largely geological, and Sir James is not a geologist or palæontologist. So, when he states that the dinosaur, *Diplodocus*, is "30 feet high," and that the horns of the dinosaur, *Triceratops*, are "each many feet long," we must make some allowances. And we are sorry that Charles R. Knight's well-known restoration of the Sabre-toothed Tiger is not credited to him.

These and other small palæontological slips do not detract in any serious way from the main body of the book, which is astronomical. The charming stories, dramatically told, of how the various celestial objects have come to be as they are, and the impressive comparisons with familiar objects and phenomena are enthralling. It is with astonishing clearness that he answers the questions that all of us have wondered about.

A few astronomical slips have crept in, such as: the confusion of radius and diameter when comparing Earth and Venus on p. 131; in describing Mars on

p. 142 reference is wrongly made to an illustration of Mercury; the statement on p. 155 that Eros comes nearest the earth, of the asteroids, when both Delporte's Body and Reinmuth's Body were known before this book was written. But these are insignificant mistakes, and do not lead to serious misunderstanding of the main theme of the story.

Sir James himself at the beginning of the first chapter very well summarizes his book when he writes as follows: "As we travel through time, we shall try to . . . show not only the present, but also the past and the future, of the universe. We shall see the sky as it was a million years ago, a thousand million, and possibly even a million million years ago; we shall watch vast colonies of stars, each like the sands of the seashore in number, being born, living their lives, and finally dying. As one tiny incident in the great drama, we shall watch one inconspicuous grain of sand — our sun — being broken up in great turmoil and finally producing a family of planets. We shall watch one of the smaller of these planets — our earth — coming into being as a globe of hot gas which gradually cools, and ultimately becomes a suitable abode for life. In due course we shall see life appearing, and finally man arriving, taking possession of his tiny speck of dust in space, surveying with astonishment the strange universe in which his life is cast, and looking wonderingly and perhaps anxiously and fearfully into the future."

And, again, at the close of the book, speaking of the appearance of life — the greatest mystery of all, he says: "It is very humble at first but gradually increases in complexity until finally, only a few minutes back on the astronomical clock, man emerges, and starts gradually and slowly to climb the long steep ladder of civilisation. Yet only within the last few ticks of this clock has he concerned himself with the meaning of the nightly pageant of the sky. Then Egyptians, Chinese, Babylonians and Greeks began in turn to wonder what it all meant. Only one tick ago the telescope was invented and gave us the means of finding out. Within that one tick almost all I have told you has been discovered, and many thousands of times as much besides. And with our knowledge of the skies increasing at its present rate, who shall say what strange surprises the next tick of the clock may have in store for us?"

— CLYDE FISHER AND H. S. RICE.

Sails Over Ice. By Captain "Bob" Bartlett with a foreword by Lawrence Perry. Charles Scribner's Sons, 1934. Octavo. 301 pp. Illustrated and with sketch chart of eight voyages inside cover.

THIS is a running narrative by her owner and master of the "Effie M. Morrissey's" nine voyages into northern ice-infested seas in the summers of 1925 to 1933. Captain Bartlett was Peary's sailing-master on his finally successful North Polar expeditions, and is generally recognized as the most skillful (or "lucky") navigator of northern ice today. It seems to be a game

played against that cold, remorseless, unreasoning Goliath, the North, full of chances which spell defeat or destruction if not promptly met as they fall hap-hazard, but a game wherein wide knowledge and experience coupled with quick action and a fighting heart, load the dice in favor of one who loves it.

The ups and downs of the ship on these voyages are recorded, ice avoided, storms weathered, damages repaired, escape from cruel grip of uncharted rocks where she had grounded. Bartlett writes, "The Arctic can be beautiful when it is in the mood, no doubt about that. It can be warm, and pleasant, and attractive. But this isn't often the case, and I don't suppose any one goes into the north to have a pleasant time. It is an adventure pure and simple." In the foreword Lawrence Perry says, "This book is the story of the 'Morrissey' since he has owned her." For the ship herself these voyages have been an adventure story, and for that reason (or because it was what the publisher wanted) such is what we have. Though full of human interest, it is the characters intimately connected with the ship's adventures or those that give them a romantic slant that are featured. The purposes of the voyages are merely brought in sketchily or at random, and there is little material with a direct natural history bearing, though the author is a close observer of natural phenomena and doubtless could write interestingly of them.

However, to those of us who have been associated with the American Museum of Natural History for years, this is no longer merely an institution of learning and education, a fine building, magnificent collections or a public playground. Men who at one time or another have had a part in its manifold activities and purposes remain a very living force in the Museum. Among them Robert A. Bartlett is certainly to be counted, and this comes to mind as we read *Sails Over Ice*. — J. T. N.

Exploring With the Microscope. By Raymond F. Yates. D. Appleton-Century Co. New York. 1934.

HERE is a useful aid for the beginner in microscopy. This is an unpretentious volume in non-technical language. It is written for the hobbyist who desires to explore the world of microscopic life, but who would become hopelessly discouraged by more advanced books on the subject.

After the first chapter, in which the author discusses the vastness of the microscope realm and prepares the beginner for the surprises that await him, are a number of short chapters answering many questions that might perplex the novice. Different types of instruments are discussed and the merits of each explained. Terms, new to the beginner, are defined in the text.

With the aid of diagrams the writer tells how to build simple but efficient equipment useful in the work.

The beginner is told how to find interesting specimens. He is advised to start on everyday things from about the house and back yard. He is given many hints on adjustment of the microscope and on problems of illumination. If carefully followed, these should save the amateur from many of the pitfalls so often encountered in this work.

In the chapter, "Building an Album of Nature's Wonders," the author tells how to prepare microscope slides. In another chapter called "The Teeming Jungle of Microland," he describes many of the interesting plants and animals to be found in a freshwater pond. Toward the close of the book there are hints on making photomicrographs and a brief chapter on crystals as observed through the microscope.

Exploring With the Microscope serves its purpose well. It is a useful volume for the beginner in that it teaches him the "A B C's" of microscopy.

— R. R. COLES.

A Preliminary Note on The Reptiles of China

THE Reptiles of China" by Clifford H. Pope is the title of a new volume which is being set in type by G. P. Putnam's Sons, New York, for the American Museum of Natural History. This volume will comprise Volume X of the series of 12 quarto volumes which the Museum is publishing on *The Natural History of Central Asia*. This series of large volumes constitute the final reports of the Museum's Central Asiatic Expeditions, which were led by Dr. Roy Chapman Andrews during the years 1922 to 1930.

Mr. Pope was a member of the scientific staff of these expeditions. He specialized in reptiles and spent most of his time, while in the Orient, collecting in China. After assembling large collections in various parts of China, he returned to the Museum in 1929. Since then he has spent considerable time studying the collections and some three years in the preparation of his report. He has also had the opportunity to study the Chinese reptiles in the large museums of the United States, England, and those of continental Europe. Mr. Pope's volume is thus monographic in scope and treatment, and should be of great service

to those students and laymen who are interested in this phase of natural history. The volume, when printed, is estimated to comprise 628 pages of text, 78 line cuts, 27 full page plates, a folding map, a folding table and an index.

This is the fourth volume of the series of twelve which has been edited and ordered printed. Copy for some of the other volumes has been completed, but not edited; others are in various stages of preparation. Three volumes, I, II and IV have been printed, and may be secured from the Library of the American Museum. They deal with the following subjects: Volume I, "The New Conquest of Central Asia" by Dr. Roy Chapman Andrews, is the narrative account and review of the work of the Central Asiatic Expeditions. Volume II, "The Geology of Mongolia" by Prof. Charles P. Berkey and Prof. F. K. Morris, gives a modern interpretation and description of the geological features of central Asia. Volume IV, "The Permian of Mongolia" by Prof. A. W. Grabau, has to do with the description of the rocks and fossils found in one of the prominent limestone areas of Mongolia. All of these volumes are noted for their abundance of illustrations and the masterly manner in which the subject matter has been handled.

— CHESTER A. REEDS.

Recent American Museum Publications

AMERICAN MUSEUM NOVITATES

- No. 758. Origin of the Segmental Coloration of Amethyst and Smoky Quartz. By Clifford Frondel.
- No. 759. Mineral Inerustations upon the Edges and Corners of Crystals. By Clifford Frondel.
- No. 760. The Distribution of Rotifera on Mount Desert Island. Part VI. New Brachionidae of the Genus *Lepadella*. By Frank J. Myers.
- No. 761. The Distribution of Rotifera on Mount Desert Island. Part VII. New Testudinellidae of the Genus *Testudinella* and a New Species of Brachionidae of the Genus *Trichotria*. By Frank J. Myers.
- No. 762. Descriptions of New Birds from Mocha Island, Chile, and the Falkland Islands, with comments on their Bird Life and that of the Juan Fernandez Islands and Chiloe Island, Chile. By Frank M. Chapman.
- No. 763. Studies on *Papuina* and *Dendrotrichus*, Pulmonate Mollusks from the Solomon Islands. By Ilse Rensch.
- No. 764. New Genera and New Species of Fossil Terrestrial Mollusca from Brazil. By Carlotta Josquina Maury.

BULLETIN

- Volume LXVIII, Art. 2. The Penaeidae of Louisiana with a Discussion of Their World Relationships. By Martin D. Burkenroad.

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NATURAL HISTORY—Publication Office, 10 Ferry Street, Concord, New Hampshire
Subscriptions should be addressed to 10 Ferry Street, Concord, N. H., or to The Treasurer, The American Museum of Natural History, 77th Street and Central Park West, New York, N. Y. NATURAL HISTORY is sent to all members of the American Museum as one of the privileges of membership, \$2.10 of the annual amount received from each membership being in payment of the year's subscription to the magazine. GEORGE J. ALPERS, Advertising Manager, Advertising Office, The American Museum of Natural History, 77th Street and Central Park West, New York, N. Y. Copyright, 1935, by The American Museum of Natural History, New York



Indians of Southern Alaska

A reproduction of a painting by Arthur A. Jansson portraying a composite of native activities against a typical natural background. The canoe is bringing in a group of ceremonial visitors, while ashore the ever-present fish are being prepared for food. At the extreme right a fire is being used to girdle a log

NATURAL HISTORY

March, 1935

The Indians of the Northwest Coast

Inhabitants of a land rich in scenic beauty, the natives of the region lying between Puget Sound and southern Alaska have developed an art and a social organization unique among the peoples of the world

BY RONALD L. OLSON

*Associate Professor of Anthropology,
University of California*

ALONG the two-thousand-mile fringe of the Pacific coast lying between Humboldt Bay in northern California and Yakutat Bay in Alaska there flourished, until recent years, one of the most unique and colorful civilizations of aboriginal America. The cultures of most of the rest of North America have been enriched to a greater or lesser extent by the spread of arts and institutions from the high civilizations of Mexico, but the peoples of the North Pacific seem to have been too far removed from Middle America to profit culturally from that source. Between them and Mexico lay the culturally barren areas of California and the Great Basin — an effective barrier against cultural contacts from the south.

From Puget Sound northward the coastal belt is extremely mountainous. But subsidence and glacial action have combined to form long fjord-like inlets which reach back into the heart of the coastal ranges. Off the mainland coast lie thousands of islands, ranging in size from mere specks of rock to Vancouver Island (300 miles long) and the Queen Charlottes. On both mainland and the larger islands the mountain ranges rise abruptly from the shore to snow-capped masses of from 5000 to 10,000 feet. Innumerable streams pour their waters down the sides of these ranges, and here and there

large rivers, such as the Fraser, Skeena, Nass, Stikine, and Taku, cut through the main coastal range of the mainland to the Pacific.

Although it lies in the high latitudes, this coastal fringe has a remarkably mild climate. The warm Japanese current flows northward until it strikes the Alaska coast, then swings eastward and southward along the coast, affecting the climate as far south as California in much the same way that the Gulf Stream tempers the climate of northern Europe. During the greater part of the year the winds are westerly. As they strike the mountainous coast, these warm, moisture-laden winds produce copious rains during the season from September to May. The rainfall varies from about 50 inches in the Puget Sound area to well above 200 on the northern coast of British Columbia. There are a few localities where rain falls on more than 300 days during the year. The tale is told of how one of the early missionaries made a confirmed pagan out of one of his new converts by relating to him the tale of the Deluge from the Bible. Told how 40 days and nights of rain caused a flood which covered the highest mountains, the chief gave vent to profound skepticism, adding, "I've seen it rain for 40 months, day and night, without it causing a flood!"

Mild year-round temperatures and abundant moisture combine to produce a tropical luxuriance of forest growth. Giant trees of cedar, fir, spruce, and hemlock cover mountain and valley from the ocean's edge to a



Photo by H. I. Smith

Courtesy, National Museum of Canada

(Above) Scraping a hide preparatory to tanning it



(Left) A Carrier Indian woman and her child. Her costume no longer includes even a remnant of the aboriginal, but the age-old practice of carrying a baby on her back still prevails

(Below) A Kwakiutl woman, Vancouver Island, preparing fish for storage



Photo by H. I. Smith

Courtesy, National Museum of Canada



Photo by H. I. Smith Courtesy, National Museum of Canada

(Above) A Coast Salish woman weaving a blanket from the wool of the wild mountain goat

(Right) A masked dancer of Vancouver Island

(Below) A Carrier Indian family. The Carrier, an Interior, Athapascan-speaking people, are culturally largely influenced by the Coast tribes



Photo by H. I. Smith

Courtesy, National Museum of Canada



Photo by H. I. Smith

Courtesy, National Museum of Canada

height of about 4000 feet. The ground beneath them is thickly set with the bushes of berry and other shrubs and with a dense growth of mosses and giant ferns. This almost impenetrable forest and the rugged nature of the landscape make land travel almost impossible. Travel by water would also be difficult for the native inhabitants were it not for the groups of islands which flank the coast, forming the famous "Inside Passage" from Puget Sound to Alaska. But the narrow channels and passes of the inlets and among the islands provide ideally quiet waters for canoe travel.

THE FOOD SUPPLY

In the forests and mountains such game animals as deer, bear, and mountain goat are abundant, but the difficulties of land travel make hunting them a hard task. The peoples of the region look to sea and stream for the great bulk of their food supply. Agriculture, the prime source of food for the peoples of Middle America, was unknown, except for the raising of tobacco. But no region in the world boasts a greater abundance of sea life than does this. Tides which vary as much as twenty feet between high and low water expose beaches supporting an inexhaustible supply of edible mollusks. Cod, halibut, and other fish may be caught in the ocean depths. Herring, smelt, and the oil-yielding eulachon or candlefish swarm along the beaches or in the lower reaches of the rivers at certain seasons of the year. Salmon run in the streams and rivers in such numbers that they often literally fill the channels. Seal, porpoise, sea otter, sea lion, and various types of whale are abundant everywhere. The peoples of the area make use of all these, but the salmon is the staple food, the staff of life.

Nature was prodigal in her bestowal of riches and the struggle for existence is never severe. The natives are able to accumulate a sufficient supply of food during the few months of summer to provide an abundance for the remainder of the year. A small stream has been known to yield more than a million salmon in a single season. Perhaps this superabundance of food, allowing months of leisure time, was a factor in the building up of a culture striking in its ma-

terial aspects and rich in its social and ceremonial features.

The area is occupied by tribes which are members of various linguistic stocks, but all are essentially alike in culture, and fundamentally alike in physical type. As a whole, they are similar to the general American Indian type with brown skins, broad faces, and straight black hair; but these coastal peoples resemble the Chinese-Japanese type more than do their kinsmen to the south and east. Possibly this difference is to be laid to the infiltration of Chinese and Japanese blood in fairly recent times. At any rate, the records of the past 150 years show that more than fifty Asiatic junks have been driven on the American shore during that time. Perhaps during the past 2000 years a sufficient number of Asiatics have reached the shore alive to affect the physical type of the natives of this part of America.

The region about Puget Sound is occupied by peoples of Salish speech. The Nootka occupy the west coast of Vancouver Island. On northwestern Vancouver Island and the adjacent mainland north to Douglas Channel are the Kwakiutl. The Haida live on the Queen Charlotte islands, the Tsimshian along the Nass and Skeena rivers, and the Tlingit in southeastern Alaska. In the main the culture of all these groups is similar, but in most respects that of the last four groups is superior to that of the peoples to the south.

Although they are hunters and gatherers of wild products, these peoples are not nomadic. During the summer months they go in small groups to various fishing and hunting sites, where they prepare the year's supply of food, chiefly dried salmon. But during the greater part of the year they live in huge rectangular plank houses grouped into villages. The framework of the houses consists of massive posts and beams carefully adzed and trimmed to uniform dimension. Over these are laid rafters and secondary beams. Walls and roof consist of planks split from cedar. An average house measures about 30 by 40 feet, but some are as much as 60 by 100 feet. The houses in a village usually extend in a row along the beach, facing the water. Each house is the



Geographical location of the Indian tribes of the Northwest Coast. Though culturally alike in most essentials, the tribes are linguistically differentiated. From north to south these are Tlingit (Klaskan); Haida; Tsimshian (Chimmesyan); Kwakwaka'wakw (Wakashan); Nootka (Wakashan); Bella Coola (Salishan); exclusive of numerous subgroups

place of abode of several families, for the size and the expense of construction make it impractical for a small family to occupy an entire house.

The interior of the house rises in a series of terraces or benches from a sunken area at the center where there is a common fireplace. These benches serve as storage spaces and sleeping platforms. The furniture of the interior consists of painted screens, mats, blankets, carved and painted boxes, and so on. In front of nearly every house stands an elaborately carved "totem pole," the animal and human figures of which proclaim the lineage or clan of the owner.

As remarkable as the houses, are the canoes which these peoples build. From the giant cedars of the area "dug-out" canoes up to 70 feet in length, 8 in beam, are hollowed from a single log. Crafts more beautifully formed or more seaworthy are built nowhere else in the world. In these canoes war expeditions and trading voyages of several hundred miles were formerly made. In them the Nootka voyage on the open

ocean of the boisterous coast of Vancouver Island and harpoon whales. Not the least remarkable feature of these crafts is that the trees were cut and the entire canoe built with nothing more than tools of wood, bone, and stone.

The art of pottery making is unknown in the area, but vessels and containers which serve as substitutes are baskets and boxes. Waterproof baskets are twined from spruce root fibers. Boxes are made by cutting kerfs in a board and bending it to form the sides. The open corner and the bottom are secured by driving in wooden pegs or by sewing with spruce roots. Bowls and platters are hollowed out of a block of wood, while ladles and spoons are shaped from wood or horn.

Nearly all these objects are carved or painted in the characteristic designs of the area, many of them referring to the crests, totemic animals, or the mythical ancestors of the owner. Nearly every object, whether utilitarian or ceremonial in purpose, is thus decorated. While highly conventionalized, the art style retains a certain quality of



Totem poles and houses at Alert Bay in British Columbia. These poles are now often set up in front of houses which have no relation or resemblance to the old type of architecture

In the Land of Totems

A house interior at Kitwanga, a Tsimshian village on the Skeena River, showing a conglomeration of ancient totem poles and modern tools and equipment



Photo by H. I. Smith

Courtesy, National Museum of Canada



A Bella Coola fish-drying rack. Fish and shellfish were formerly food staples for all the tribes of the Northwest Coast. The fish are split and hung on poles to dry in the smoke of the fires built beneath



A portion of the pagan division of a Bella Coola village. The lower section of the totem pole at the right is now in the American Museum collection

Photo by H. I. Smith

Courtesy, National Museum of Canada



realism. Particular features of an animal, such as the teeth of the beaver, the dorsal fin of a killer whale, are emphasized. The figures are usually distorted to conform to the shape of the object decorated, but are recognizable because the features which conventionally identify them are always present. Similar designs were woven into blankets, painted or tattooed on the body, and carved or painted on canoes, paddles, house-posts, boxes, and so on.

In contrast with this skill in woodworking is the poverty of wearing apparel. Wholly absent is the tailored clothing of the Eskimo and other northern tribes. A blanket woven from cedar bark or other fiber, a basketry hat, and a fur cloak or blanket are almost the only articles of apparel. Both winter and summer men and women went about barefoot. The reason for this difference from the majority of North American tribes lies in the fact that dressed skins (buckskin) become soggy and of no use in wet weather, hence are seldom of service in a climate as rainy as this.

THE LACK OF POLITICAL ORGANIZATION

Despite the fact that the region is fairly densely populated, and that there are large, permanent communities, there is no political organization worthy of the name. There is no consciousness of tribal unity, no central tribal authority or unified government. Society is everywhere stratified into the nobility, the commoners, and the slaves. Within the ranks of the nobility there is an intense rivalry which prevents the delegation of authority. The core of every community is the group of nobles, each one the jealous guardian of his ceremonial privileges and prerogatives, which have been handed down to him through uncounted generations. Each prides himself on being the head of a household (a "house chief") or the head of a clan or lineage. The commoners are his "poor relations" occupying his house, often doing most of the labor, but sharing slightly in the dubious glory of being the relative of a great man. These castes are rigidly endogamous, that is, no noble would disgrace himself by marrying a commoner, and no commoner could hope to better his position by marrying a noble. The slaves

are scarcely counted as human. For the most part they are war captives and the descendants of such captives. So great is the importance attached to caste that the taint of slave blood is remembered through many generations.

COMMONERS AND NOBLES

The commoners, though freemen, have few rights, little hope of bettering their position. The nobility have the wealth, the wealthy are the nobility. The nobles own or control the rights to fishing, hunting, and berrying grounds. They hold the "high names" which carry with them the right to particular seats in ceremonials, the right to give such ceremonials, the right to carve or paint certain heraldic devices as their crests upon various items of property. Even though a commoner succeeds in amassing some property, he can never hope to rise into the ranks of the nobility — that is a close corporation which is self-perpetuating.

Among the Tlingit, Haida, and Tsimshian, the caste system is complicated by the existence of maternal clans which are exogamous — that is, all clan-mates are counted as being close kin and so are forbidden to marry. Since a man takes his clanship from the mother's side, it follows that father and children always belong to different clans. These clans are further grouped into larger aggregates called moieties or "halves." Among the Haida these are known as Raven and Eagle, among the Tlingit as Raven and Wolf. No Raven may marry a Raven and no Wolf a Wolf. Membership in these is also through the female line. All personal names, all property, all ceremonial privileges and rights remain within the clan or moiety. It follows that, while men own and control nearly all property, they may not pass it on to their children — who are outside the father's clan.

This conflict of masculine ownership and female descent has resulted in some curious rules. At a man's death his property passes to his sister's son, who is regarded as next of kin within the same clan. When a lad is six or eight years old, he leaves the paternal roof and goes to live at the home of his maternal uncle, who rears him carefully, training him in the tribal customs and lore,



Photo by H. I. Smith

Courtesy, National Museum of Canada

Totem Poles

A Tsimshian village at Kitwanga on the Skeena River. Though the houses are a far cry from the aboriginal types, each is still sentineled by its totem poles. These usually represent in the grotesque, conventionalized forms of the art of the area, the family crests. Frequently the traditional animal ancestors of the family are represented in distorted human form



Highly conventionalized carving is found not only on ceremonial objects, but on the lowliest of household equipment, like the soapberry spatula-like spoons and ladle shown above

A relatively modern development among the Haida Indians is the elaborate carving of slote to be seen in small totem poles, boxes, and huge flat platters

A headdress worn in the healing ceremony. The spruce framework is covered with swan's down and further decorated with perpendicular eagle tail feathers and humun hair. The mask represents a dying man, with open mouth, protruding tongue, and gashes on forehead and cheek



The high attainment of the Indians of the Northwest Coast in woodworking finds no better exemplification than in the carved food dishes



Rattles of this conventionalized pattern are usually attributed to the Raven clan. This Haida Indian carving represents a raven on the back of a hawk



Tlingit baskets. These colorful and finely twined baskets were woven by the women from split spruce roots and artificially colored grass. Innumerable domestic purposes are served by the baskets



treating him harshly if he fails to heed. At the death of the uncle, the nephew often marries the aged widow, assumes his uncle's name, takes title to his uncle's house and other property, and in every way assumes his uncle's position. These rules obviously run counter to the instinctive desire of the father to pass his property to his own children instead of to the children of another. But so strong are the bonds of clanship, and so rigorously guarded are the ceremonial rights of the clans, that paternal instincts bow down before the purely formal rules of clan membership. A partial solution of these conflicts is achieved through the common custom of marriage with the daughter of the maternal uncle, i.e., with a cousin, so that the property goes to the nephew-son-in-law. This cousin, being of a different clan, is not counted as a relative.

"JUSTICE," FEUDS AND WARFARE

Nothing bulks so large in the lives of these peoples as clanship. Clan bonds, clan loyalties, and clan pride transcend all else. If a man is murdered, a blood feud is initiated between the two clans (it being unthinkable that anyone would kill a clansmate). Unless cool heads persuade a settlement by compensation, the feud proceeds on the basis of a life for a life. No attempt is made to kill the murderer, however, unless he be of a rank (or "value") equal to that of the murdered man. Instead, the injured clan names a person of equivalent rank, and the person so named is obligated to dress in his ceremonial robes and come out from his house to be shot from ambush by the murdered man's clansmen. To refuse would bring a disgrace upon the clan which would remain unforgotten for generations. Such a feud between clans obviously divides every family against itself and wives have been known to kill husbands, or children their father, out of clan loyalty.

Warfare (aside from blood feuds) was likewise conducted on the basis of clan against clan, Eagle clans being usually aligned against Wolf clans, seldom Eagle clan against Eagle clan.

Although the clans and moieties are always potential enemies, there are certain social conventions and obligations which

are operative between them. Among the Tlingit no man may build his own house, erect a memorial column to a dead clansman, or even conduct the burial rites for a clansman. A man of the Raven "side" must hire these things done and they must be done by the Eagles. For every such task performed the Eagles must be feasted and paid goods for their services in addition. A man of the Eagle side may not even invite the Eagles to a feast. If he gives a feast the guests must be Ravens. In a way this ceremonial reciprocity and friendship are compensating factors which tend to soften the harshness of the tremendous sense of loyalty for that wholly formal, artificial group, the clan.

No people in the world are more wealth-conscious than these inhabitants of Northwest America, in fact they have been called "the capitalists of the North." But their concepts of wealth differ radically from ours, with our hoarding of securities, of "shares" in production goods. Theirs involves the accumulation of goods, it is true, but in the form of consumption goods for the most part — of foodstuffs, blankets, and so on. And their wealth is hoarded not for its own sake but in order that the owner may give it away in a grand ceremonial splurge known as the "potlatch" — literally a "giving away" feast. Every occasion or event of importance demands the giving of one of these ceremonial feasts by some noble of the clan, village, or household. His is the privilege and the obligation of representing his social group, of acting as host-agent for his poor relations. No one is born, no one reaches puberty, no one is married, no one dies, but some clansman must give the required feast to maintain his own honor and the prestige of his clan. No one may build a house or rear a memorial column without giving a costly feast.

Preparations for such a feast often involve years of planning, saving, and the making of arrangements with clansmen for loans. For it is but seldom that a single individual has sufficient means to bear the expense by himself. Tremendous quantities of foodstuffs must be collected for the feasting. Immense numbers of gifts, such as blankets, canoes, slaves, and so on must be



Courtesy, Canadian National Railways

Skeena River, British Columbia

Living on the Skeena and Nass rivers are the Tsimshian Indians, whose villages formerly extended for some distance inland along these streams. Though living in an environment differing somewhat from that of the coastal and island peoples, culturally the differences were small. The Tsimshian carried on a brisk trade with the coastal tribes, securing from them food and other products of the sea not available to them in their own habitat



Photo by H. I. Smith

Courtesy, National Museum of Canada

At the left is shown a fish weir near Duncan, Vancouver Island, and below is a trap on the Bulkley River, British Columbia. Formerly salmon were most commonly taken in weirs built across or at the sides of streams. These varied considerably in form, as they were adapted to local conditions. Fish were also taken by speuring, by trolling, with nets stretched between canoes, and with hook and line



Photo by H. I. Smith

Courtesy, National Museum of Canada

on hand to pass out as presents. Usually the prospective host calls on all his clansmen in the home village to aid him. Since the giving of such a festival reflects glory on the entire clan no one can refuse help at such a time. Some time before the actual feast is to begin invitations are sent to the several clans or villages who are to be the guests.

THE CEREMONY OF THE POTLATCH

The entire ceremony, from the moment of the arrival of the guests, through the several days of feasting, is hedged about with an almost incredible amount of ceremony and formality. The seating arrangements are as carefully planned as at a diplomatic banquet. The place in the house where a given guest is to be seated depends wholly upon his rank in society, and this in turn upon the rank of his forbears. He inherits the right and privilege to a seat at a designated spot, or rather to a seat which has a particular name. In the giving of food the man of highest rank must always receive first, then the man of next highest rank, and so on. Throughout, there are elaborate formalities and speeches couched in ritualistic language.

After several days of feasting comes the time of the actual giving of gifts. Sometimes these gifts amount to tens of thousands of dollars' value in our currency, but are in the form of trade blankets, canoes, slaves, ceremonial objects of copper, and other objects of value. As in the case of the feasting, the guests of high rank receive first and receive the lion's share of the values involved. Commoners receive later and get only things of nominal value. At the end of the distribution of gifts the guests return home, and the impoverished host and his clan await the certain invitation to a similar return feast, at which they will be the recipients.

Wealth has served its end. Though well-nigh bankrupt, the host has created respect for his name and has glorified the name of his clan. His children will be grateful to him as well, for, although they are not of his clan, the fact that a father once gave a great potlatch will be remembered in the stories which go the rounds of the years. As Murdock has phrased it, "Amongst ourselves a man and woman may save and

sacrifice to send their children to college; [Northwest Coast] parents give a potlatch. Only the method is different; the motive is the same."

Among some of the tribes intense rivalry centers around the giving of potlatches. Each chief tries to outdo the other. No proffered gift may be refused, yet its acceptance obliges the recipient to return an equivalent amount within a year — plus 100 per cent interest! Obviously such a give and take cannot continue for long, for no people in the world can double the "national wealth" each year for an indefinite period. In some cases these rivalries involve the actual destruction of property. Behind all the types of potlatch lies the concept that a man of wealth must show his contempt for wealth by giving it away, as if he had so much that its giving away made no difference. What better way of showing contempt for wealth than by destroying it? On occasion, slaves have been killed, valuable "coppers" thrown into the ocean, and great ocean canoes smashed to bits by the host in order to humiliate a rival. But this represents an extreme form of the potlatch, one out of harmony with the more common type found in this area.

* * *

In this brief sketch I have tried to outline some of the salient features of this unique culture which differs so markedly from others of Native America. A region of tremendous wealth of food supplies enabled the inhabitants to achieve a certain amount of leisure. Probably out of this grew the system of rank and caste based upon lineage and wealth. Out of this developed an exploitation of the natural resources which allowed the accumulation of vast amounts of goods. The sense of values revolved not only around rank and wealth, but developed along æsthetic lines as well, as is witnessed by a remarkable art style. The societies of the region are acquisitive in about the same sense as is ours. But the values, the motives are somewhat different. We accumulate wealth for the sake of the income it produces, with prestige a secondary factor. With them, prestige is all important and prestige cannot be achieved by mere hoarding.

Spring in the Garden

Even before the trees come into leaf many of the most beautiful of garden flowers are bright with blooms

BY CAROL H. WOODWARD

New York Botanical Garden

Photographs supplied by courtesy of the N. Y. Botanical Garden

WHETHER one's garden consists of a simple border of flowers or a vast estate comprising many types of plantings, the first crocus that opens its chalice with the passing of the winter's snows is a thrilling signal to gardeners of every station that spring is making its bow to the impatient world.

It is still too early to do garden work outdoors, except to complete those important tasks of digging and double-digging, fertilizing, and otherwise improving the soil — all tasks which should have been done in the fall, but which can be handled, if previously neglected, as soon as the ground becomes workable in the spring. There is also time for a last application of dormant sprays to the shrubs and trees that need protection from insect enemies — time, that is, if the leaves are still tightly wrapped in their winter coats, for dormant sprays, being extra strong, will promptly kill any young leaves or open buds they touch.

March is a good month, however, to start indoor work for the outdoor garden, but even for this a warning must be issued not to be over-zealous in sowing seeds. Only a few subjects — *Begonia semperflorens*, verbena, petunia, snapdragon, Iceland poppies, and some asters and zinnias for early bloom, for instance — can with wisdom be started the first of March. Most of the annuals (except those whose seeds are best sown in the bed where the plants are to bloom) and many perennials for next year's flowering grow most successfully if seeds are started indoors the middle of March.

While the home gardener is busy inside — mixing and sifting soil, scrubbing clay pots and filling them, leveling the surface, watering, and scattering new seed across the top, then sifting on the last fine soil before put-

ting the pots aside, covered carefully with panes of glass and sheets of newspaper — the spring panorama is rapidly progressing outside his door. Except for such early shrubs as forsythia and jasmine, and some trees like the maples, which shake out their gay, scarlet tassels before the leaves appear, the crocuses, snowdrops, squills, and glories-of-the-snow, which have been set in the ground the previous fall, come into bloom in a world that is cheered chiefly by their bright flowers and leaves.

Snowdrops (*Galanthus*) really precede the crocuses in early spring, blooming frequently while snow is still on the ground. Because of this, their nodding, graceful, white flowers are scarcely a harbinger, but rather merely a hint of the coming spring. It is not till we see the crocuses, with their deep cups of lavender, yellow, and white, that we are convinced that the season of flowers approaches.

If we have not already cautiously lifted the winter covering from the borders, we will find, with the opening of the earliest crocus, many determined looking spears of green pushing their way toward the light, each cluster enfolding fat buds of squills and glories-of-the-snow. Within a few days their loose spikes of waxy white and vivid blue will be rivaling the early crocuses for recognition. The gardener with a sense of color combinations learns the exact tone of each variety of *Scilla* (squills) and *Chionodoxa* (glories-of-the-snow), and keeps discordant blues among these two flowers well separated by clumps of white and by the occasional pink that is sometimes found in both groups.

Incidentally, the gardener who wonders whether it really is *Scilla* or *Chionodoxa* that is coming up (the two look so much alike to the unpracticed eye), may be comforted by the fact that botanically they are so closely related that the two genera may be hybridized, producing what has been called a



Late
Spring

The increasingly warmer days and abundance of green on the shrubbery entices one into the garden retreat to enjoy Darwin tulips, with lilacs blooming overhead





Daffodils

Broad drifts of these gleaming golden and white flowers will blossom year after year when naturalized as though growing wild. Below are some of the types most frequently seen in gardens. At the left, "Thalia," one of the most graceful of the smaller trumpet daffodils; left center, "Epic," pure white with an orange border to its yellow crown, one of the Poet's Narcissi; right center, "Elizabeth Ryan" whose yellow crown is edged with white, one of the Barrii hybrids; right, narcissus "Her Grace," a large, pale-yellow trumpet



Chionoscilla. The most noticeable difference between these two flowers is that Chionodoxas have a short tube to the corolla, whereas among Seillas each perianth-segment (or "petal") is distinctly separated from the others, usually to the very base.

THE ROCK GARDEN

Quite different are the compact blue spikes of grape hyacinths, of which every gardener knows and loves that most commonly grown species, *Muscari botryoides*. About the time some of the miniature daffodils appear — the hoop-petticoat, *Narcissus Bulbocodium*, for instance, — grape hyacinths may be found standing among them like uniformed cadets in a ballroom filled with gold-skirted ballet girls.

Turning to the rock garden on a sunny day in March, we find the broad cups of the green hellebore already nearly spent. Then suddenly we discover how early the bees appear in the spring, for, when bending over to catch a whiff of fragrance from the first flowers of the rock-cress, we find that the bees are already enjoying their sweetness. The double-flowered rock-cress, which persists in bloom into the early summer, makes a handsome plant, but is seldom as fragrant as the single, early-flowering form.

Named *Arabis*, because it presumably came from Arabia, the rock-cress is not to be confused with another member of the Cruciferae, or Mustard family, one species of which adorns many a spring garden. This is the evergreen type of the common candytuft, *Iberis*, named from Iberia — ancient Spain — where many species grow wild. The common name of candytuft, by the way, refers to the island of Candia, or Crete, from where the first species was introduced into cultivation.

The fleeting patches of brilliant yellow that one sees in the springtime garden are the flowers of another indispensable crucifer, *Alyssum saxatile*, variously known as golden-tuft, basket-of-gold, or golden alyssum. The gray leaves of this, like the dark leathery green of the evergreen candytuft, *Iberis sempervirens*, adorn the garden throughout the summer and fall.

An unexpectedly sturdy-looking flower

for this early in the year is the leather-leaf saxifrage, *Saxifraga* (or *Bergenia*) *crassifolia*. Its large, deep pink blossoms and broad, leathery leaves make a striking spot of form and color in rock garden or border. Set near the top of a slope in a rock garden, this plant is useful in keeping the soil from washing down the hill.

The brightest blue among the flowers of the spring is that enchanting species of *Anchusa* which so closely resembles a glorified forget-me-not that it has been named *Anchusa myosotidiflora*. Fortunately for the true forget-me-nots (*Myosotis*), if they do appear before their garish rival has ceased blooming, their choice of a moist, rich, partly shaded spot keeps them well separated from the sturdy sun-loving *Anchusas*.

But we are getting ahead of our story, for while we have been inspecting the borders and rock gardens, acres of daffodils have come into bloom. Many of these, it is true, are found among the other flowers, but they are most delightful when a broad stretch of land can be strewn with the bulbs, which will come up year after year in ever-increasing numbers, requiring virtually no attention further than letting their leaves ripen until about July. In the garden, after the flowers are gone, the leaves can be pinned inconspicuously to the ground with a forked stick or bent wire. In the open field or on a hillside, the easiest plan is simply to forego cutting the grass until a slight yellowing of the narcissus leaves indicates they have finished their work of manufacturing food which has been carried down to the bulbs in order to nourish the next year's growth.

THE FIRST DAFFODILS

The first of all daffodils to come into flower is the tiny variety *minimus*, one of the true trumpet daffodils (*Narcissus Pseudo-Narcissus*), of which there are countless fine horticultural varieties. Many of the large-flowered trumpet types bloom while the trees are still bare of leaves. One often goes out to enjoy the early daffodils during an April snowstorm.

Comfortable days, however, soon come to stay, and with them come many more



Snowdrops and crocuses are first to herald the spring, the nodding, waxen white flowers like those at the left often blooming while snow is still on the ground, while the crocuses open long before the grass turns green



*(Below) Rock-cress
spreads its fragrance and
attracts bees early to the
alpine garden*



*(Above) Basket-of-gold
alyssum combines with
Poet's Narcissus for a
pleasant border effect. (Be-
low) Japanese cherries
bring an unfailing snow-
fall of flowers in May*

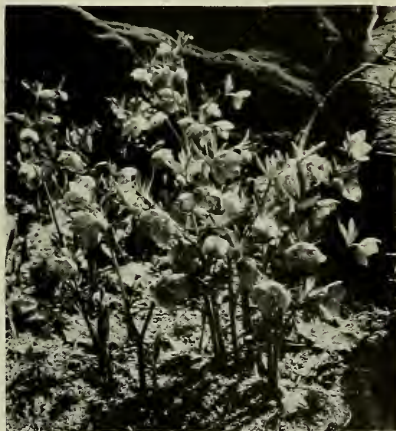




*(Above) Naturalized buttercups carpet the ground beside the woodland pool.
(Below) Green hellebore blooms and is gone from the garden before the spring sunshine has aroused the other plants*



(Above) Evergreen candytuft is a blithe flower for springtime bloom, and its leaves ornament the garden throughout the year



varieties of *Narcissus* — especially the types with crowns of medium length — *incomparabilis* and its varieties, with flowers three and four inches in diameter; the many *Barrii* hybrids, with smaller flowers and shorter crowns, originally all sulphur yellow, but varying through extensive breeding even to an occasional border of red; also some of the choice and increasingly popular milk-white *Leedsii* hybrids.

A few of the trumpet daffodil hybrids blossom quite late in the season. The true jonquil (*Narcissus Jonquilla*), which bears comparatively slight relation to the "jonquils" — the trumpet daffodils — of florists' windows, spreads its bloom over a large portion of the spring season. This is a small, graceful, highly fragrant flower of rich deep yellow, with hollow, rush-like leaves of glossy dark green. Admirably hardy in the region of New York, neither it nor its name is sufficiently well known in gardens.

With the exception of some of the late hybrids of large- and medium-crowned types, the last of all the *Narcissi* to bloom are the Polyanthus (*N. Tazetta*) and the Poet's *Narcissus*, or Pheasant's Eye (*N. poeticus*). Especially of *N. Tazetta* are there more hybrids than could ever be counted, some of which, like the Paper-White, are too tender to grow outdoors. Others, however, are perfectly hardy, and, with their broad leaves and clustered fragrant flowers, some pure white, some all yellow, and others yellow and white, they make pleasant additions to the springtime garden.

THE LATE SPRING GARDEN

The Poet's *Narcissus*, well known for its widely expanded white flowers with small, red-ruffled crown, is another delight of the late spring garden. *Narcissus poetaz* is a fairly recent hybrid which combines the clustered flowers of the Polyanthus type with the size and general appearance of the Poet's *Narcissus*, adding to these good qualities a pleasant fragrance and a graceful manner of growth. These, however, are generally used for forcing in the greenhouse, not being quite hardy enough to raise outdoors in northern states.

Before the late-blooming daffodils are

gone, the dwarf iris come into bloom in many colors — yellow, white, all shades of purple, blue, and many tones of brown. Rugged little plants are these, presaging a long season of magnificent bloom from their bigger brothers, the medium and tall bearded iris.

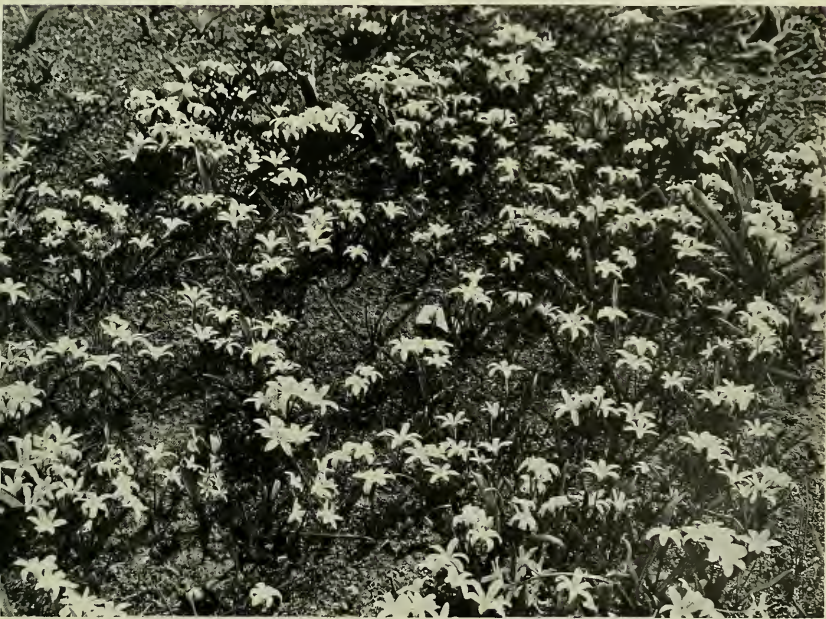
TULIPS

Meanwhile, the tulips have been brightening the scene — first the early single tulips, low in stature, pure in color, and like thin silk in the texture of their petals. After them come double-flowered forms of these varieties; then the cottage tulips, usually of medium size and great diversity of color. These are the ones most often seen bordering shrubbery, walls, and fences in the spring, and frequently used for long-season bedding effects. Last come the Darwins, magnificent, tall plants with large flowers of exquisite color. Darwins seem more a hothouse type of flower, yet it is perfectly possible, with the usual fall planting of bulbs under proper conditions, to produce beautiful Darwin tulips for late-May bloom around New York. The bulbs, however, must be renewed at least every other year. Bulbs of the smaller types of tulips may stay in the ground for several years without deterioration, if the leaves are not cut until after they have ripened.

Curious, unfamiliar tulips are now being seen in the intimate corners of rock gardens, where many amateur fanciers are now devoting themselves to species rather than to horticultural hybrids. One of the most charming of these is *Tulipa Clusiana* (widely shown of late years in border plantings at the International Flower Show in New York). This slender, graceful "Little Lady" tulip in cherry-and-white stripes is typical of the attractive species that it is possible to raise, if one will make the effort to obtain them and watch over them carefully. Such attention to species which have been little known in horticulture may bring interesting "new" types of tulips into general use.

How, in fact, did any of our garden flowers arise, except by gradual adoption and development of wild plants? Some of the prettiest of our spring flowers in the

*Blue appears in the
springtime garden
when the grape hya-
cinths (right) and
glories-of-the-snow
(below) come into
bloom*



garden are native wild flowers that have been brought in from woods and fields. It has taken a long time, however, for Americans to learn to appreciate their own native plants. Even the humble skunk cabbage, whose mottled mahogany spathe adorns brooksides and marshy places before there is a sign of green roundabout, has been taken up gleefully by European gardeners, who like this strange — though evil-smelling — precursor of spring.

In fact, in many gardens across the ocean can be seen flowers familiar to every American who knows the woods and fields in spring. Bloodroot, anemones, and other favorites of native haunts have been introduced into gardens abroad with great success.

CULTIVATION OF WILD PLANTS

Of late, there has been a pronounced movement in this country to bring wild flowers into cultivation. Such was the purpose of the New York Botanical Garden's expedition into the southern Appalachians in the fall of 1933. Many wild plants from there are now being tested for garden use. Meanwhile, individual growers and a few nurseries are trying to discover the best means of cultivating wildings from all parts of the country — for they do not always take to civilization agreeably. As a result, many wild plants are now being

offered for sale — and it should be added that this is usually the best way to procure them, rather than trying to transplant them from the woods oneself. Wild flowers are precious things, and unless an experienced hand is taking care of them in the garden, the lives of the tenderer ones, at least, are doomed.

FOR BORDER OR WILD GARDEN

Some, however, are easy to raise either by transplanting or by seed. The Virginia blue-bell, *Mertensia virginica*, makes a successful and beautiful spring flower either in border or wild garden. The early wild blue phlox, *Phlox divaricata*, is equally delightful. Especially suited to naturalistic plantings are the wild geraniums and buttercups, while the dainty spring beauty, *Claytonia virginica*, makes a pleasant mass of pale pink in either a garden or a wooded spot. Columbine can be massed among other flowers in a border or scattered over a slope in a wild or rock garden. Meadow rue, which flowers early with inconspicuous little tassels, provides fine greenery for both the garden and house all summer long.

To many lovers of the out-of-doors, the violas and pasque-flowers frequently used in eastern gardens in spring are pleasantly reminiscent of the large violets and native pasque-flowers of the middle western prairies.



Submarine Power Plants

Fish that generate electricity with which to shock their enemies and overcome their prey

BY C. W. COATES

New York Aquarium

OF ALL the devices employed by nature to protect its children or to insure their food supply, there is none more remarkable or less easily explained by investigators than the electric powers possessed by certain fishes. Living in a medium through which any man-made electricity passes with the greatest of ease, and through which man has the greatest difficulty to carry his electric power in cables without loss, these fishes have perfect control of their charges and discharges, using the electricity stored in their bodies as seems best to them in their fear or hunger.

There are several kinds of electric fishes, but, while they have much in common, they are not closely related. There is an electric cousin of the common American bullhead living in Africa, in almost all the tropical fresh waters, and there are a number of electric rays scattered about the oceans of the world. These latter, the Torpedos and the related genera *Raia* and *Hypnos*, are probably the most commonly encountered of all the electric fishes, for one or another of them is found off almost all temperate and tropical coasts. They have even been encountered in British waters. The electric stargazers — Uranoscopids — may be stepped upon, buried up to their eyes in the sand of our coastal waters, but their electric power is not to be compared with that of some of the other fishes. The electric eel of northern South America is, however, the most famous of them all. Some of the Nile Mormyrids have small electric batteries. The deep impression made upon the ancient Egyptians by these fishes is indicated by bronzes and paintings. Pictures of the fish were incorporated in their hieroglyphics.

The Arabs of old knew of the electric catfish, which occurs also in the Upper Nile,

and called it "thunder fish." Compared with even a small catfish, the Mormyrid would have felt like a small flash-lamp battery, and a full-sized catfish of three feet might have put a new god in the pantheon of the Egyptians. On the other hand, if either the Arabs or the Egyptians had met a vigorous electric eel in the full flush of its electricity, their Mormyrid and thunder fish would have seemed pallid and insignificant indeed.

All of the electric fishes except the catfish (*Malapterurus electricus*) have electric organs of muscle tissue which has become modified into electric tissue. These are usually in the tail region, although that of the Torpedo is in the head. The battery of the catfish is a sheathlike affair which covers almost the whole body between the skin and the underlying muscles. All the organs, wherever situated and of whatever kind, are controlled by the nervous system of the fish, and the method of production of electricity seems to be similar in all cases. It is generated and stored in the cells of these tissues which, when a discharge is liberated, seem to develop a polarity of their own, the negative of one touching the positive of the next, and the discharge is thus of a myriad of tiny storage batteries. The eel alone seems to have power to regulate the intensity of the shock, but how this is done is still a mystery.

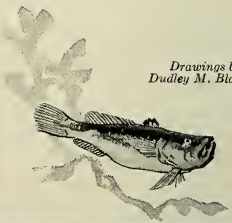
However, although the electric organs have a definite location in the anatomy of each fish, we have been unable to find any part of any electric fish which does not become electrified when touched. There is not, apparently, any insulated material in the animal's body.

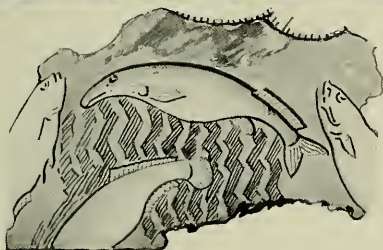
As far as we know, the electric eel is the only one of this group of remarkable creatures which uses its power in the pursuit of food, although the Torpedo may do this to a minor extent. The others seem to use it solely as a defense mechanism — a very ef-



The electric catfish shown at the left inhabits the fresh waters of Africa. The Arabs call it the raab, or thunder fish. The large picture at the bottom of the page shows the Torpedo which, though it is capable of transmitting a sharp shock when interfered with, soon exhausts its batteries. There seems, however, to be some question about the electric powers of the stargazer, shown immediately below. Those who have stepped on it with bare feet, however, are in no doubt whatever

Drawings by
Dudley M. Blakeley





The long, lithe fish shown above is the electric eel, which is to be found in many of the rivers of northern South America. It is, by a wide margin, the most powerful living generator of electricity. At the left is shown a copy of an Egyptian wall carving of a Mormyrid. Despite the rather weak electric powers of this fish, it was still sufficiently striking to be venerated by the ancient Egyptians

ficient defense, it may be said, for, upon one's touching the fishes, they liberate enough electricity to make one let go in a hurry, even though the shock is expected.

The eel, besides this defense activity, discharges a shock when an animal which may be suitable for food swims anywhere near it. The unfortunate victim, immediately paralyzed, is then an easy prey to be inspected at leisure. If, for any reason, the eel does not swallow the paralyzed animal, it will recover in ten or fifteen minutes, none the worse for its experience.

Both the eel and the catfish have been the subject of much more study than any of the other electric fishes, probably because they are more easily kept in captivity. The *Mormyrid* is a delicate creature which may be kept alive in an aquarium only for a day or two at most, and that with the greatest difficulty. *Raia* and *Hypnos* have not strong batteries. The Torpedos, which have strong batteries, do not seem to be particularly happy in captivity and do not survive long. The catfish, however, provided it is given a tank to itself, seems to thrive well. It is a curious thing that two or more of these electric catfish never seem to get along together at all, for invariably, if they are kept in the same aquarium, they will shock each other so much that in less than a week there usually is only one left. When a catfish is the subject of a discharge from another catfish, that part of the skin which was in contact and received the shock seems to be partly destroyed and becomes loose and broken, and the fish dies soon thereafter. This has been recorded for many years by observers who have commented upon it without explaining it. Nor have they been able to advance any theory to cover the apparent immunity enjoyed by the fish while in transit, for usually a number of these creatures are shipped in the same container without suffering damage. It seems that they become dangerous to each other only in the comparative comfort of an aquarium. It may be that they are so miserable aboard ship that they have no energy left to discharge electricity.

Contrarywise, the eel is in full possession of its powers when it travels, as has been proved by costly experiment. Seeking to

prove or disprove the electric power of the fish, a doubting Thomas will seize one in his hand, and then an eel is usually lost, for the current immediately turned on by the eel causes the muscles of the hand to contract and squeeze the fish. This in turn causes the eel to release more electricity, and in a few minutes the unfortunate fish may be almost squeezed in two. The electricity ceases, of course, when the eel dies.

When these fish do arrive in the tanks of an aquarium, they do very well. Two which were taken to London many years ago, when they weighed less than one pound each, grew so rapidly that six years afterward they weighed about fifty pounds each. One animal in the New York Aquarium increased in length from less than three feet to more than five feet in two years.

Contrary to the catfish, the eels live well together. Indeed, they seem to derive certain benefits from the company of their kind, for, when several are kept together, only one or two will discharge enough electricity to paralyze sufficient food for all, the others apparently keeping their electricity in reserve. Perhaps they know that their electric organs may be run down like a battery, and that it takes about two hours for them to generate a fresh supply of electricity, meanwhile leaving the fish absolutely defenseless.

These animals are exceedingly difficult to handle, for one does not have to be in contact with the fish to feel the shock. It may be felt from the water or from the dry, wooden handle of a net and, if there is the slightest moisture about, through rubber gloves. Persons skilled in handling the creatures will purposely disturb them considerably before attempting to remove them from the water, so that as much electricity as possible may be discharged harmlessly. This is not the case with the electric catfish, whose electricity is not noticed to any great extent unless one is in direct contact.

There is still a great deal to learn about the natural electricity of these electric fishes, for their energy, which seems to follow all of the laws of ordinary electricity as we know it, still seems to have peculiar properties of its own which follow no known electrical laws.

The Mountains of Glacier Park

An account of one of the youngest sections of the Rocky Mountains, and the steps by which these peaks have developed

BY CARROLL LANE FENTON



Courtesy Glacier Nat'l Park, Photo by Hileman

AS THE traveler in northwestern Montana nears Glacier National Park, he sees a mountain wall rising without foothills from the plains. Between them runs a line so sharp that he feels he can put his hand upon it, once he reaches the foot of the range.

Just as the line becomes most clear, a western village intervenes. Its sunburned buildings of logs and boards have never known the coolness of shade. Its chief street swims in a haze of dust, in which horses, cars, and paintless wagons stand before the trading post. Men in high-heeled boots lean against brown walls, speculating on the number of "dudes" that will come on the afternoon train. Said one, "Them rock-hunters was comin' back for more of them things they call fossil plants. . . ."

Thus the geologist is welcomed to mountains that are both beautiful and young.

Barely 60,000,000 years have passed since this section of the Rocky Mountains first appeared as a low chain of hills; many of their peaks took form within the last thousand centuries. If these figures still seem large, recall that the Appalachians have passed the 200,000,000 mark, and yet are by no means the world's oldest highland.

Despite their comparative youth, these ranges hold rocks that are very old. Formed in Proterozoic times, their age may be estimated at about 600,000,000 years. When they gathered, Montana was the site of a sea stretching southward from the Arctic Ocean, perhaps joining waters with a bay advancing from Arizona. Into this basin many rivers drained, bringing loads of sand, silt, dolomite, and lime, that hardened into strata of stone. For millions of years these strata grew, until they formed a varied series of rocks with a full thickness of 60,000 feet.



Pages from a

The two slabs of sandstone in the photograph below show the borings of marine worms, made before the solidification of the material of which the rock is formed



A ledge of limestone, built originally by marine plants some 600,000,000 years ago, but now lying on an alpine pass. These fossil plants give glimpses of the life that existed in this region during Proterozoic time



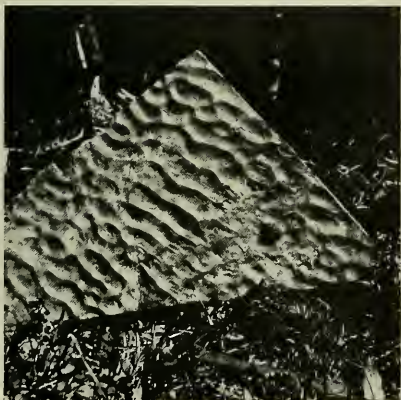


To the geologist, the rocks of such mountains as these tell a great deal of the story of their origin. The stratification, shown so plainly across the face of the tall peak, contains a whole page of geologic history, while the folds, the fossils, and other geologic details add further to the story

*Courtesy Glacier Nat'l Park,
Photo by Hileman*

Geologic History

The triangular slab of stone below bears ripple marks formed by the waters of some ancient lake or sea that once existed where Glacier Park now lies



(Above) Ages ago this slab of rock was mud. As it dried, the cracked edges turned down — evidence that the water in which it formed was salty. Where fresh-water lakes dry up, the edges of the cracked mud turn upward

More doubtless were added in later ages, whose record has vanished from the mountains of today. But at last sinking gave way to uplift; rocks that had lain beneath the sea were pushed upward into land. On that land appeared dinosaurs with short front legs and ducklike beaks, and others whose bodies were sheathed in armor. They wandered through swampy glades where today are the plains of Glacier County, Montana — and they fled before a Cretaceous sea whose muds now lie beneath the mountains.

THE RETREAT OF THE SEA

Soon that sea itself retreated before a vast earth-shove from the westward. Before it, hard rocks bent upward in folds. Pushed farther, they crumpled and broke, slipping and grinding their way over beds that once had been above them. When the earthquakes of uplift stopped, the rocks had traveled upward many thousands of feet and eastward at least thirty miles. Mountains of Proterozoic stone stood upon crumpled Chalk-age shales. Between them lay the Lewis Fault: the break along which the mountain mass had moved. Its front became the line one sees as one approaches Glacier Park from the east.

Later came the glaciers themselves, deepening chasms first cut by streams, planing the cliffs below every peak. Once they melted but reappeared; today sixty small ones survive, remnants of a vanished Ice age. Their work, as well as that of old seas, accounts for the scenic features of the Park.

Scenic beauties made first appeal when, sending our camp outfit by bus, we took the trail to Two Medicine Valley. At our feet were cliffs of buff limestone and marble; above were slopes of satiny green, dipping westward to a glacial lake. On these green foundations stood mountains of red, topped by gray and ochre pinnacles. Other red peaks, hung with snow, formed the distant Continental Divide.

Each color had its special meaning — as we learned in following the trails from our camp among the lodgepole pines. The buff limestones tell of a quiet sea, to which streams brought only dissolved lime and the mineral called dolomite. But sometimes that

calm disappeared; gales from a semi-desert shore carried clouds of sand and even small stones, to drop them upon the lime. Their rough grains on weathered ledges still record those ancient storms.

Shallow water must have been the rule in Montana's Proterozoic sea. Beds of lime-, mud-, and sandstone unite in bearing ripple marks that were made when breezes swept broad shoals. When the wind changed, waves built new ripples across those already formed; on a pass not far from another camp we found beds of cross ripples so perfectly built that their crests form almost exact squares. Breezes must have been uncertain indeed on that special shoal.

Currents also swept near shore, building ripples with one side steep, not symmetrical like those of waves. We found the best ones near a glacier so small that, until we climbed and looked down upon it, we thought it a mere patch of snow.

But what were the dark red chips and balls, buried in layers of sand? They seemed to have rolled, snowball style, across a bottom of sticky mud. Storms set them upon this path of growth; reaching shallows, they stranded in the sand. Among them settled bent bits of mud, also torn up and dropped by the waves. Even limestones and shales show such scattered chips, as we found when we came to follow the trails along the Continental Divide.

A RECORD OF STORMS

Over thousands of miles and through millions of years, the Proterozoic waters remained so shallow that the slightest uplift drove them away. Then the sea floors lay bare in the sun, to be pitted by hailstones and drops of rain before they hardened. A single ledge often showed us records of storms on both land and sea, in its mud balls, pebbles, and pits made by rain.

It also might show that the barren muds cracked, as pond floors do when they dry today. But the edges of cracked pond muds curl up; those ancient ones lay flat or turned down. To find such marks in formation today, we must go where marine or brackish muds lie exposed to the air and sun.

But must the mudstones of Glacier Park be marine? The late Doctor Walcott thought



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Swiftcurrent Lake

At the foot of Mounts Wilbur and McDermott lies Swiftcurrent Lake. Sixty small glaciers still survive in Glacier Park, marking the remnants of a vanished Ice age. Between the peaks lies Iceberg Lake, fed by one of these remnant glaciers. See page 219



© Hileman



(Left) Here a flow of submarine lava is shown. The lumps or "pillows" characterize lava that hardens under water



(Below) Two mosses of fossil algae now estimated to be 600,000,000 years old



*(Left) In Granite Park.
The stone chalet is perched
on a hardened lava flow.
Near it are beds of green
shale containing many
fossil algae*

*(Right) Uplifted by the
giant forces of nature,
rocks are to be found bent
and broken even in places
that lie miles from the
present front of the
mountains*

*(Below) A section of the Continental
Divide. At the foot of limestone walls
2000 feet high lies Iceberg Lake. Across
the face of the cliff are well marked
strata formed by the remains of com-
pactly grown plants which flourished
ages ago*

© Hileman



they, and the limestones, had formed in huge lakes. Prof. Joseph Barrell compared them to the beds left when streams overflow and cover wide plains with silt.

We have kept both theories in mind through four summers of geologic work by trail, and frequent study in the laboratory. We are not yet sure that the problem is solved — but we have found no evidence of lakes, and a great deal of seas. And Barrell's streams were strangely salty, for the very beds he ascribed to floods abound in saline mud cracks, and casts of what once were crystals of salt. If stream deposits exist (and they may!) we have been unable to distinguish them from others laid down in bays.

But what do the fossils say? For animals, they are sadly incomplete: two slabs bearing burrows of worms that we found while on our way to a pass where we hoped to photograph mountain sheep. One rock bears what may be trails and burrows of mud-dwelling clams, the oldest of their kind in the world. Supposed crustaceans described by Doctor Walcott proved to be broken fronds of plants — apparently brownish-green seaweeds.

Their fossils lie at the foot of a cliff near the scenic center called Many Glaciers. A few feet above rise massive beds formed by closely packed, oblique columns. Each column is oval in section, consisting of hundreds of thin layers like saucers piled bottom-side-up. They were built by colonies of algæ, which formed layer on layer of lime as they grew. Thus, even while alive, they formed compact beds of stone.

The thick green and red formations have not given us one fossil plant. But scarcely did lime bottoms return when a new sort of alga appeared, building "biscuits," domes, or compact beds. Scattered widely through the Park, these fossils are most abundant on two of its southern passes. There they lie among dwarf willows and snow, above slopes where queer little alpine plants sink roots two feet into the ground to anchor a three-inch crown of leaves. When we first found them, a mountain goat stood on a ledge formed by these marine fossils!

Though these algæ lived in shallows, they had no such problems as those which faced a species found in greenish shales near the

crest of the Continental Divide. They dwelt in a windy bay, on layers of hardened and cracked mud that a few months before had been land. When waves swept inshore, they were overturned; submarine lava flows burst forth, burning them to red, brittle balls. Yet between eruptions the algæ returned, only to meet a similar fate when new cracks opened and lavas emerged.

The tale of these struggles and defeats is told on a fir-grown slope called Granite Park, where a chalet built of red sandstone stands upon the tumbled lavas. Visitors often marvel at the view — but few realize the dramatic past recorded by those peaks and ridges of stone.

From Granite Park a fern-fringed trail leads to the Going-to-the-Sun Highway. There, in 1932, we discovered two fossil reefs, more perfect than those diagrammed in textbooks. Our roadster stopped with a jerk; out came notebooks, hammers, and tape for the capture of this new, rare find. The most perfect reefs we ever had seen — 600,000,000 years old!

RECORDS OF THE PAST

As we measured, sketched, photographed, we noted how the plants of the reefs had varied to meet each different need. Where crowded, they grew in compact cones; on exposed spots, they formed wrinkled sheets. Higher, they took on spongelike form, while out on the open, uncrowded mud, they grew in flattish biscuit shapes. Such biscuits, we already knew, sometimes grew to enormous size. Had we not seen two, ten feet in width, in a basin where a glacier once headed, below windswept Boulder Pass?

In our camp among cedars and Douglas firs, we reviewed the meaning of those reefs. Not merely did they prove four "species" one, through the intricacies of variation. They gave us a picture of simple organisms, meeting the problems of life long ago as simple organisms meet them today. We had traced shallows, waves, floods, eruptions in the rocks; at last we knew with some confidence their effects on the plants living on and among them.

But animals? They still offer a problem, to solve which we plan new seasons of work in the mountains of Glacier National Park.

The Story of Silk

Based on the skilled ability of countless adept workers, upon whose care and dexterity the excellence of the raw material almost entirely depends, silk has, for thousands of years, been used to create the world's preëminent fabrics

BY DONALD D. LEONARD

THE origin of silk is lost in antiquity. Legend tells us that some 4000 years ago the Chinese princess, Se-Ling, dropped a cocoon which she had found in her garden, into her cup of tea, and discovered that it was possible for her to unwind the strong, continuous fiber from the softened exterior.

The ability to convert the cocoon filament into yarn, and thence into fabric, developed by slow stages, but there is ample evidence that silk cloth from the hand looms of China was an important part of the load transported by the camel caravans to the mighty Persians, and later to the imperial Romans. Pompey returned from his Asian campaign in 81 B.C. wearing a gorgeous silk robe, which apparently established the style among the elite of the day, for a silk fabric dyed purple commanded a price at the rate of \$1,800 a pound. During Justinian's reign, about 550 A.D., two itinerant monks succeeded in smuggling out of China some silkworm eggs in the handles of their canes, thus establishing the entomological origin of the beautiful fiber. It is uncertain whether the good Fathers were properly rewarded for their patriotic service, but for some time their information proved to be of only academic value to their rulers, since the proper feeding of the young worms had to be learned, and the technique of converting the cocoon into yarn had to be developed. The seed of the European branch of the industry, however, had been planted.

Meanwhile, in China, the domestication of silk-producing moths was developing into an industry which was intimately to affect the lives of millions. Several species of moths were employed at first in the produc-

tion of the fundamental cocoon, but gradually attention was concentrated on one moth, *Bombyx mori*, which is, today, the species that is universally bred and used by sericulturists the world over. *Bombyx mori* is as unconscious an ally in the provision of human wants as the sheep which grows a warm coat of wool, for, in the natural sequence of its life-cycle, the larva spins a covering to protect it during its remarkable change into chrysalis, and again into moth. In his treatment of this protective covering of the dormant worm, man is, however, more ruthless than with the sheep, for the worm or its chrysalis is destroyed in obtaining the fiber.

To obtain this fiber, the procedure in its fundamental steps remains the same as that of the earliest farmer who realized that the production of cocoons meant a cash crop with which to supplement his meager yield from rice or garden truck. These steps were to harvest the cocoons when completed and to soften them in hot water, so that the continuous fiber which the worm had spun could be smoothly unwound on to a drum or spool.

The great improvement in technique came when the farmer realized the disadvantage of having to search for the casual occurrence of cocoons on the natural and only food of the *Bombyx*, the mulberry, *Morus alba*. He then permitted some of the moths to emerge from their silken envelopes, to mate, and to lay eggs. These were hatched into tiny worms, known as "ants," which greedily consumed many times their weight of the fresh mulberry leaves that were fed to them.

During five stages of feeding, interrupted by four moults, the voracious insects matured in little more than one month into a grayish-white, firm-bodied caterpillar about



Gunze Raw Silk Mfg. Co.

The only satisfactory food for the silk-worm is mulberry leaves. At the right is shown a farm in Japan where this food is grown in large quantities. Above, workers are engaged in feeding large leaves to almost full-grown worms

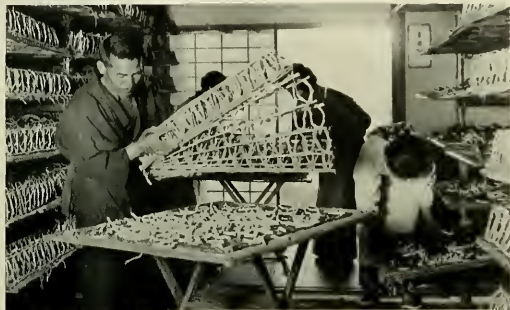


Morimura, Arai, and Co.

(Below) Providing a convenient structure or frame to which the full-grown worms may attach their cocoons. This process is known as mounting



Gunze Raw Silk Mfg. Co.



Gunze Raw Silk Mfg. Co.

(Below) Here finished cocoons, ready to be sent to the sorting room, are being plucked from the frames. Above is a glimpse of the sorting room, where experienced girls are sorting the cocoons according to color, size, shape, and texture, to facilitate the reeling of uniform raw silk



Yamamura, Arai, and Co.

three and one half inches long, which lost its interest in food and sought a cluster of projecting twigs to which to attach the scaffold of its temporary home.

The farmer who had successfully controlled the location of the mating of the adults and the rearing of the young, next saved himself much of the time and effort he had expended in looking around the farm for the cocoons, by providing suitable cut branches, and then straw frames, on which he carefully dropped the worms ready to spin. When the resulting cocoons were collected, some chosen for reproduction and the remainder prepared for reeling, the strictly agricultural phase of the industry was completed.

Eventually, tremendously increased demand for silk forced the development of large scale business in the production of cocoons, and the outlay of cash by the farmer-sericulturist for more silkworm eggs and mulberry leaves than he could provide on his own land.

The success of the crop was subject to much the same variables that confront the raisers of cotton or wheat, or hogs, with the additional hazard arising from the fact that the silk fiber exudes from the interior of a caterpillar which is subject to indigestion, and attacks by fungus and parasite, and with a constitution so delicate that a severe thunderstorm may seriously disturb the even flow of its liquid filaments.

HOW THE INDUSTRY DEVELOPED

For centuries these problems were solved to a great extent by the experience gradually acquired by the farmer and his family, particularly the women, who were especially fitted for the care and skill necessary in handling the little insects. During the Nineteenth Century, growing demands for more and better silk fabrics caused some degree of specialization and coöperation by those farmers who, by good luck and application of semi-scientific principles, had become sellers of the white or yellow ovals to other men, who decided their best profit lay in the industrial conversion of the cocoon by uniting many fibers into the thread that is known as raw silk.

This separation of the industry was not

abrupt, either chronologically or socially. Some Chinese farmers undoubtedly continued to raise cocoons from which their wives made yarn for their garments, while contemporary peasants in the Near East were shipping all their cocoons into Italian reeling factories, called filatures. At the same time some Japanese rice growers, for example, probably were producing a side crop of cocoons both for their domestic use and for sale to their urban cousins who operated a reeling plant. And even today there continues this uncertain and changeable status of consumer or seller, which exists so peculiarly in agricultural pursuits.

CHANGES IN SUPPLY AND DEMAND

This uncertain status exists not only among individuals, but also in the case of countries, so that, in the course of five-year periods a nation which has been a large producer of cocoons and an exporter of raw silk, has become an importer of raw silk. This change has been due to factors other than mere supply of cocoons, in one country, and demand for the reeled fiber in another country. Soviet Russia, for example, has been a large producer of cocoons for many years, but only within the last three years has it shipped raw silk to the United States. It is reasonable to believe that the demands of the Five Year Plan have made desirable the building up here of as large a cash balance as possible in United States dollars, to be used for the purchase of heavy machinery and other American goods, and that the Russian raw silk has been employed as a governmental cash crop for revenue and trade balance.

When a study is made of the occurrence of sericulture throughout the world, it is interesting to realize the extremely widespread distribution of this ancient industry: the world is literally circled by silken threads. From the standpoint of quantity of cocoons produced, the present status is approximately as follows, listing the greatest producer first, to the smallest: Japan, Italy, Korea, China, U.S.S.R., Persia, Turkey, Greece, Syria, Bulgaria, Macedonia, France, Brazil, Yugoslavia, Spain, Rumania, Egypt, and Czechoslovakia. From the standpoint of exporters of raw silk to America,

the list is much smaller, and includes, in order of importance, only Japan, China, Italy, and U.S.S.R.

Japan is by far the greatest silk producing and shipping country. United States is by far the greatest importer and consumer of silk, and yet there is no American raw silk industry. This absolute dependence on other countries for raw silk has been the reason for many attempts in the past to establish a domestic source of supply, and important political pressure has been used to bring about an import duty on the fiber, so that an infant native industry might be nurtured.

PROMISES OF WEALTH

The agitation usually started from the sale of mulberry trees, or slips from trees, which were to be planted as a start of a separate business that promised fabulous profits to those who were in on the ground floor. The fortunate owners of the mulberry trees were to sell their leaves as food to those who were going to raise the worms. Country-wide interest developed in the Eighteen-sixties, and fortunes were made and lost speculating in a food for caterpillars which never existed. Even during the last fifteen years, serious attempts have been made in California to introduce mass production methods into sericulture, but all efforts have failed, not because we do not have enough mulberry, for it can be grown; not because cocoons cannot be produced here, for fair samples have been displayed from, at least, New York, Alabama, and California; but because American labor cannot compete with the low cost of Asiatic labor in the most important phase of the whole industry — that of reeling the cocoon into raw silk of a quality that our market demands.

A consideration of the various steps in the large-scale production of cocoons and the technique of reeling the raw silk suitable for our use, will convince the most patriotic American that no tariff walls should be raised against this product of our foreign suppliers.

The first step in which the manager of a reeling factory is interested is the first step in the life cycle of the *Bombyx mori* — the

egg. In Japan especially, where the government has a decidedly paternalistic interest in the industry, the production of silkworm eggs is controlled in many cases with the exactitude of a pharmaceutical laboratory. This is best demonstrated in the case of the largest reeling organizations, which breed their own worms, and raise their own disease-free eggs, in order to safeguard particularly against an hereditary affliction which often permits the larvæ sufficient term of life to consume quantities of expensive mulberry leaves, only to die before spinning its envelope. The freedom from disease is effected by a post-mortem examination of a solution of the body of the female parent, whose eggs have been laid on a numbered square on a cardboard, and which eggs can be removed from the egg card and destroyed if the parent is found to be unhealthy. The good eggs are then sold to farmer-coöperatives, who operate with the filatures on some arrangement by which they agree to sell to that filature the ovals spun by the worms hatched from the eggs. This arrangement assures the reeler of at least a minimum supply of cocoons produced in the area surrounding his mill, and helps to insure uniformity of quality and availability.

The functioning of these farmer-coöperatives is the weak link in the chain of complete control of the industry which so nearly is attained by the reeling organizations, for, except in a very limited degree, the reeler is dependent on many farmers and their families for their raw material — cocoons — which are the greatest single item of cost in making raw silk, about 75 per cent of the total expense.

A "HOME" INDUSTRY

The care and labor of the people who handle the growing insect furnish the most interesting human touch of the whole business. Members of the family often incubate the eggs by carrying the egg-cards inside their clothing, and when the newly hatched "ants" arrive, the entire home is given over to their care. It means a twenty-four-hour-a-day routine to feed them, and to clean the trays on which the mulberry leaves are sprinkled. Changes in heat and cold, mois-



In scientific breeding, the female moths lay their eggs on cards that can be stored until the eggs are wanted for hatching. At the left are pictured typical storage frames

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A full-grown silkworm magnified to about twice its actual length. It has finished feeding and is searching for something upon which to attach the first outer layers of its cocoon

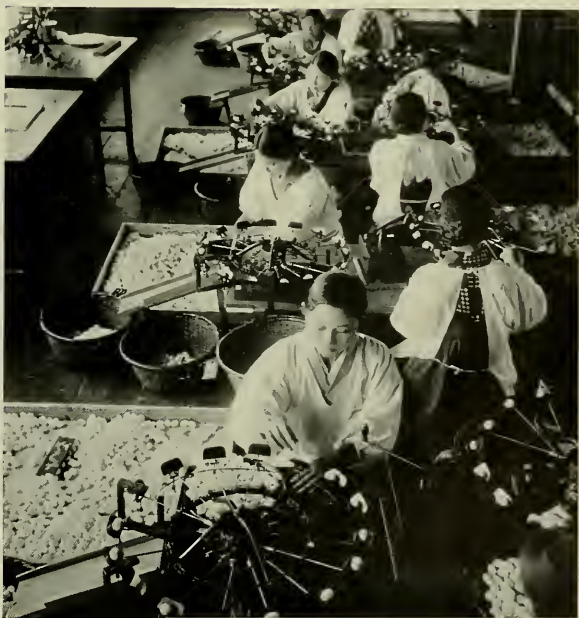


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Certain moths are allowed to hatch from the cocoons in order to perpetuate their kind. The cocoons broken open by the emerging adult are unfit for reeling, but have other uses. Shown about actual size



Determining the sex of the insect in order to make possible proper breeding. This determination is made by weighing, the female being heavier

Morimura, Arai, and Co.

ture and dryness, affect the physique of the worm, the value of which depends wholly upon the nature and dimensions of its final secretion. In the model sericultural annexes of the major factories during the spring season, a continuous overlapping succession of stages of the caterpillar is nursed in rooms like hospital wards, so that the whole larval existence of about a month may be seen in adjoining rooms. The Dionne quintuplets in Canada scarcely have more careful attention than the young *Bombyx mori*, but it pays when the cocoons go to market, which happens as soon as they are spun and before the moth can spoil them by emerging.

The markets are on the order of auction sales, where the highest bidder takes the lot. The value of cocoons depends upon their size, shape, texture, and yield—the quantity of fresh cocoons required to produce a certain weight of raw silk. The farmers and their harvest pour into the market place by foot, rickshaw, pushcart, wheelbarrow, wagon, and motor truck, and the long care and labor of the industrious sericulturist have their financial reward.

HOW RAW SILK IS MADE

After the cocoons change hands they are rushed to huge drying ovens, where the living organism inside is killed, so that the cocoons can be stored until they are required by the reeler: the dehydration also reduces the possibility of damage by mildew. Throughout the world, there are many localities where filatures and drying ovens are not available, and where the farmers and their families reel their own thread. By immersion in very hot water, the insect inhabitants are killed within their shells and the natural gum which cements the texture of the protective envelope is softened, allowing the women to unwind the fibers through a guide on to a drum, revolved by hand or foot-pedal. The resulting skein is prepared for use in weaving, and raw silk, of a kind, is made.

This process of manufacture by the peasant women of Japan, China, Bulgaria, Italy or elsewhere, is essentially the same as that of the modern factory, but the quality of the product would find no market in the United States, where the increasingly strict

standard of the American shopper has established a goal toward which all raw silk producing countries have reached, but which only Japan, China, and Italy have attained. The refinements of the process, by which the present commercial raw silk is made possible, are the story of the modern steam-operated filature.

The principles governing the modern reeling factory are the general formulæ of big business—efficiency, economy, mass-production, and especially supervision, and they become effective upon receipt of cocoons into the sorting room. Here they are examined, much as hens' eggs are candled, and separated according to color, size, shape, and texture. From the sorting room they go to the boiling apparatus, where an endless-chain system of wire cages carries them through a series of hot and cold baths, accurately timed to thoroughly soak the cocoon walls inside and outside, so that the gummy coating of the fibers is partly dissolved and the adhesion of the adjacent portions of fiber is lessened. This soaking does not injure the quality of the strand, if not carried to excess, because less than 1 per cent of gum is removed, leaving around the filaments a protective covering which is about 20 per cent of the total weight of the finished raw silk.

If eventually a laboratory test is made to determine the actual percentage of gum content, by boiling the raw silk in an olive oil soap solution until all gum is removed, the dual nature of the fiber is disclosed. When the worm spins its oval, the fluid from the silk sacs is expelled through two minute spinnerets close together in the lower jaw, and the liquid immediately congeals into two parallel filaments, technically called fibroin, cemented together and covered by the glue, called sericin. The sericin is an indispensable protection for the filament during all the reeling and subsequent manufacturing operations.

When the reeling girls receive the cocoons, big business temporarily relinquishes control into the hands of each individual woman, whose highly developed sense of sight and touch and timing are responsible for the poor, good, or superior quality of the skein she creates. Upon the skill of each girl

To Market



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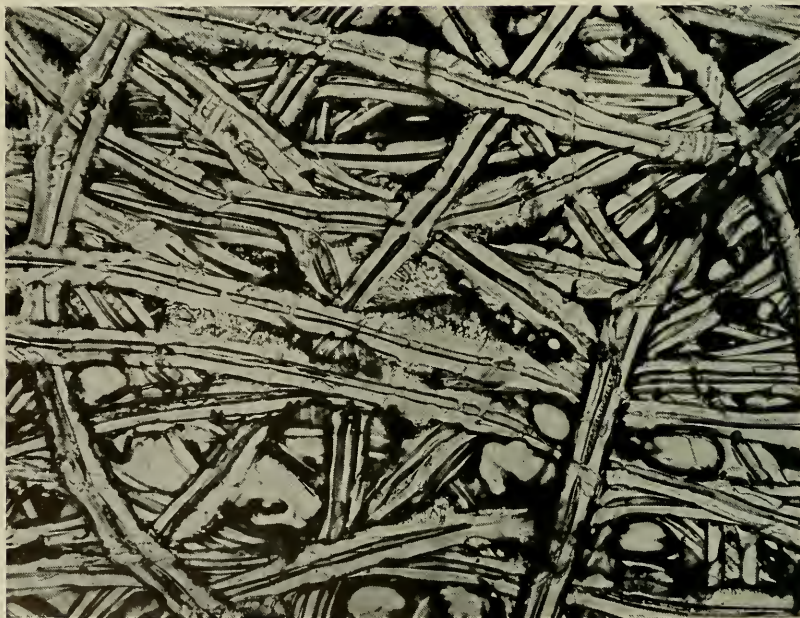
The cocoons are rushed by the farmers to various cocoon markets where their crops are turned into cash. Speed in transit is essential, for there is always danger of the moths emerging en route. Above, coolies are shown arriving at a Japanese market. Inside the building an auction sale is in progress. This method of cocoon trading is typical of Japan and China



A newly started cocoon with a thin wall showing the method used by the worm in secreting the filament. The worm moves its head in a figure-eight motion, building up the walls in a succession of similar designs, as may be seen in the light lines in the photograph. The cocoon illustrated is enlarged about four times

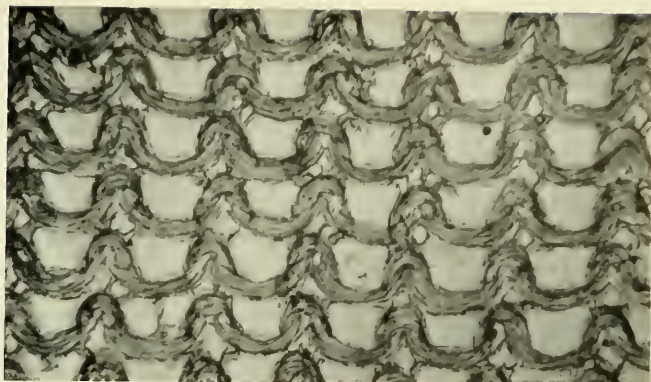
A photomicrograph of the surface of a cocoon. It shows how the secretion of the silk worm is composed of two filaments of fibroin surrounded and connected by a gummy substance called sericin

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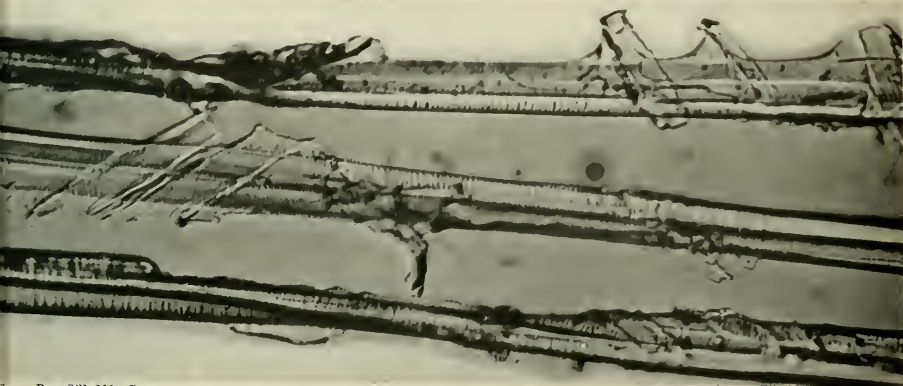


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A photomicrograph of silk hosiery fabric, showing the loops formed in knitting

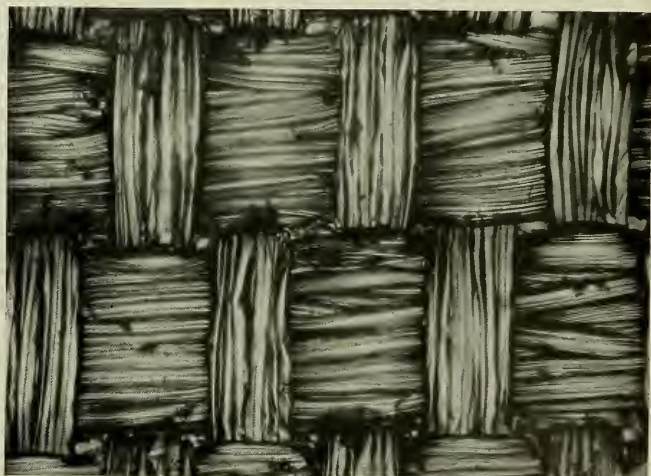


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(Above) A photomicrograph of stretched cocoon filaments, showing irregular portions of the gum which contribute toward making irregularities in the diameter of a silk thread



A photomicrograph of a piece of woven silk fabric

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depends to a large extent the reputation of the mill, and the selling price of its product.

Students of sociology and economics would be much impressed with the problem of reproducing in America the conditions surrounding this industry in the Far East. If it were merely a question of plant efficiency or the development of machinery to do away with hand labor, the reeling business would long ago have become a subsidiary in the United States, of fabric mills. However, the students would recognize the interesting fact that raw silk is not essentially a machine-made, but a handmade article, and that the so-called reeling "machines" are really only tools in the hands of more or less skilled workers, and that the value of the thread depends largely upon the manipulation of many cocoons soaking in a basin of hot water. These highly capable women work more hours a day than any American laborer, even before N.R.A., and are paid about $\frac{1}{2}$ Yen a day (with the Japanese Yen currently worth $28\frac{1}{2}$ ¢ U. S. money) plus board and lodging, with very infrequent holidays. Yet the result of their labor is the most important export of Japan and China, and the basis of our most beautiful fabrics.

REELING

The work of the reeling girls consists in uniting the end of four or more cocoon fibers into a continuous thread of a comparatively uniform diameter. This thread is attached to the circumference of a rapidly revolving drum which pulls the fibers vertically away from the reeler at the rate of several hundred yards a minute. Since the usable length of fiber on a cocoon is between four and seven hundred yards long, it is constantly necessary to add more fibers to maintain the running length of the thread. With the free, outside ends of the cocoon in one hand, the girl throws end after end with the other hand on to the moving thread, and it sticks and lays parallel by means of the wet, gummy sericin. As each strand joins the running thread, its cocoon bobs about in the basin, held down only by the weight of the water it contains, and if the gum is insufficiently softened to permit absolutely smooth removal of every portion

of the cocoon wall, the cocoon jumps after its end until it is stopped by a porcelain eye through which the thread passes. The combined fibers are given cohesion, and some of the water is squeezed out of them, by twisting the thread back on itself in a spiral contact several inches long. From there it goes on to the drum, and the product would be essentially raw silk, lacking refinements.

THE NECESSITY FOR CARE

However, raw silk without refinements has no market in the United States, which buys 75 per cent of all the world's exportable supply. It is in her ability to improve the quality of her running thread that the reeling girl demonstrates her importance in the process of making a thread uniform enough to be used in the severest requirements, such as sheer hosiery. In reeling, the girl attempts first to maintain in the running thread an unvarying number of cocoon fibers, each of the same diameter. This is really impossible, because every fiber changes its individual diameter throughout its length, being thin at the start and finish, and thicker in the center of its length, so that the reeler must not merely add cocoon ends in a mechanical manner, but must cast them on in a way to avoid the joining of all heavy or all thin portions, and must glue together, for instance, two heavy and three thin portions of cocoon fiber. Besides watching this evening-up process, the operator must produce a thread with a circumference as nearly smooth, like a glass rod, as possible.

In short, the girl must reel a thread with the maximum degree of uniformity, regularity, strength, elasticity, and ability to be easily worked in the American mills. The degree of perfection which she attains, combined with some difference in the quality of cocoons employed, makes this raw silk worth as little as \$1.35 or as much as \$2.75 a pound.

Many attempts have been made to use mechanical devices for joining the cocoon ends into a thread, but no device has yet been perfected that will consistently produce a quality as good as the girls can make, at as low a price. Until such a machine should be evolved — and it seems improb-

A packing room in a filature. Here the tightly twisted skeins are shown tied into "books" ready for baling and shipping from Japan to other countries

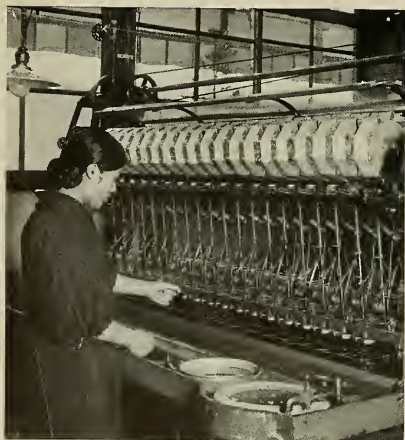
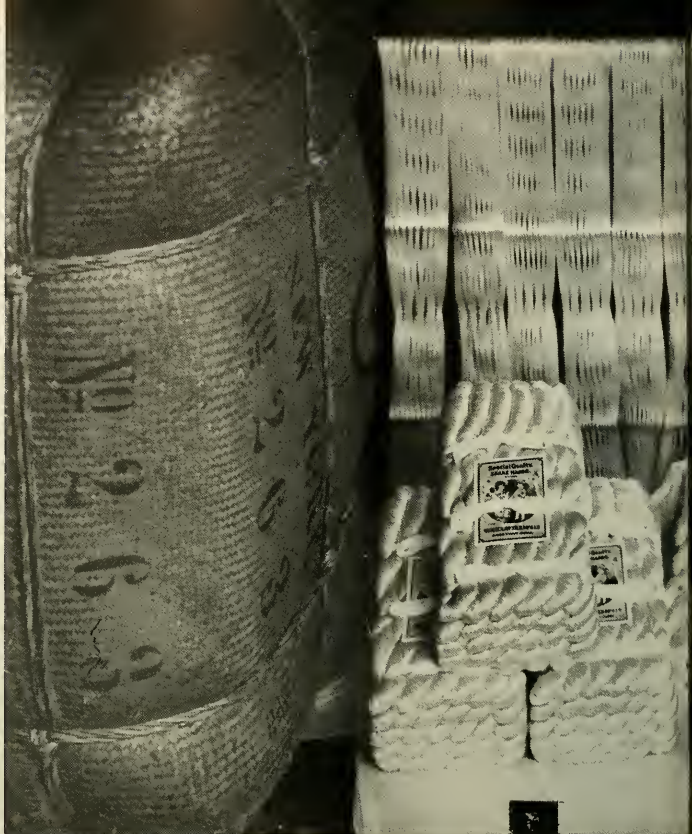


*Photographs from
National Federation of Textiles*

Bales of raw silk after arriving in the United States. At present raw silk from all the principal exporting countries is received in much the same condition



The four pictures below from left to right show (1) A modern reeling machine with one girl making twenty skeins; (2) The process of twisting the skeins tightly to conserve space in packing; (3) Operator in an American mill, uniting several strands of raw silk into multiple thread yarn for use in weaving cloth; (4) Weaving yarn into silk cloth



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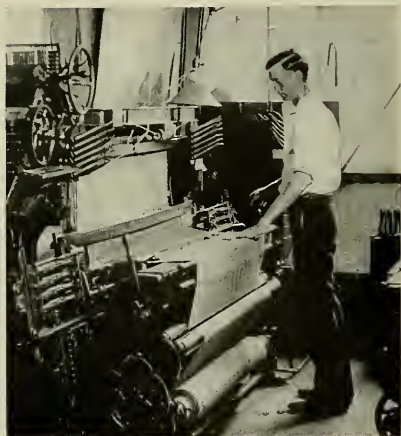


The large photograph shows the steps in preparing the silk for shipping after it has been reeled. From right to left the silk is shown on drums, from which it is wound on to six-armed reels, then laced, twisted, tied in bundles, packed into cotton bags, and protected by straw matting

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Cheney Bros.



National Federation of Textiles

able — the important commercial production of raw silk will remain in the skillful hands of the women of the Far East.

After the combined fibers are reeled around the drum, they are reeled on to another frame, into skeins of a fairly uniform weight, then tied, inspected, twisted, and packed into bundles called "books," and then into bales of about 133 pounds, for shipment abroad. To fill rush orders, the bales are unloaded directly from the ship's hold into waiting express trains on the docks of the Pacific coast ports, and speeded without stop to New York, for distribution to American manufacturers of yarns and fabrics.

THE USES OF SILK

It is interesting to realize that this material called "raw" silk, because it is the raw material entering into the manufacture of numerous yarns and fabrics, is in reality a "finished" product, the result of long, skillful, and expensive preparation and labor in the countries of origin.

The greatest part of all the raw silk imported into this country is converted by our manufacturers into multiple-thread yarns with from two to twenty ends, twisted together by three to seventy turns per inch. This processing gives the delicate cocoon strands sufficient strength to resist the action of high speed looms and knitting machines, and also imparts the crêpy appearance so characteristic of certain fabrics.

In the knitting of women's full-fashioned hosiery, the greatest reliance is placed on the ability of the filature to reel raw silk of the most superior quality, for the manufacturer of hosiery knows how carefully his stockings are examined by the women who buy them.

Other familiar uses of silk are: women's dresses, hats, lingerie, shoes, gloves, sweaters, and bathing suits; men's suits, pyjamas, neckties, shirts, and scarfs; home furnishings like curtains, rugs, comfortables, lamp shades, sheets and pillow cases, tablecloths and napkins, and upholstery.

Additional less familiar articles in which silk is employed are: Mohammedan prayer rugs, church vestments, football pants, fish-

lines and flies, tennis racket strings, insulation for wire, waterproof tobacco pouches, oiled silk raincoats. Also, silk enters into military use for cartridge box cloth, balloons, dirigibles, and parachutes. Commercial articles are bolting cloth for sifting flour, typewriter ribbons, tents, dental floss, and violin strings. Doctors use silk thread for stitching surgical wounds and for artificial ligaments.

Much could be mentioned regarding the strength and durability of the product of the little caterpillar, in contrast with its fineness of diameter. Iron wire has a tensile strength of 90,000 pounds per square inch; that of silk is 64,000. The size of raw silk used in hosiery knitting is so fine that there are 319,000 yards to the pound, and the exportable bales from Japan only, in 1933, contained about 19,421,325,000,000 yards of raw silk of various sizes.

This same 1933 Japanese export of about 73,000,000 pounds, was the result of the life work of some 220,000,000,000 worms, about 3000 cocoons being required to make a pound of raw silk. The worm which spun the cocoon ate fifty times its own weight in mulberry leaves. These leaves were grown, and worms raised on them, by more than 2,000,000 families in Japan alone, providing employment for an additional 100,000 mill workers.

THE ECONOMICS OF SILK

These statistics will indicate the economic importance of the silk industry to Japan, and it occupies a strategic position also in the balance of trade of China, Italy, and the United States. Our country buys 85 per cent of its total consumption of raw silk from Japan, and in return sells to that country huge baleage of American cotton, worth even more than the silk, which, however, provides most of the money to pay for the cotton.

From international balances to individual preferences, silk plays an important part in the lives of all of us, and it is hoped that the story of silk may impart a new interest to the users and wearers of the Queen of Fabrics.

The Elk of Jackson Hole

An evaluation of the problem brought about by the increasing herds of elk on the limited ranges that have been set aside for them

By OLAUS J. MURIE

*Bureau of Biological Survey,
U. S. Department of Agriculture*

AS THE 1934 hunting season opened in Jackson Hole, Wyoming, great concern was expressed by many people over the elk situation, particularly because a portion of the Teton State Game Preserve, for many years kept an inviolate sanctuary, was this year opened to hunting. The gist of opinion, both local and elsewhere, appeared to be that the elk were getting "a dirty deal."

At the risk of adding unduly to the already voluminous literature on the elk, I should like to discuss them once more and state frankly my impressions of the present situation.

First, why do we want the elk? Why all this furor over an animal? Is our interest selfish? Commercial? Altruistic? It may be worth while to examine our motives, for they underlie our actions. I should like to review our various viewpoints, how different ones of us make use of wildlife, and enjoy wildlife. To do so, and before discussing the present hunting season, let me go back and relate some personal experiences.

One day in July I had climbed to the summit of a high, bare ridge, and sat down on a prominent point to rest and to sweep the landscape with my glasses. Below me, in rolling undulations, stretched the forest, with numerous open parks. At one side the ribbon of Pacific Creek wound its way toward the valley, the upper Jackson Hole, the distant parts dimmed in the haze of a quiet summer day. And before me, emerging from the mist of the valley, rose the Tetons.

At first there was little sign of active life. A Clark's nutcracker flew by me with strident wing beats, high over the tree tops, and disappeared in a grove of white-barked

pine. There was a clatter of pebbles as a fat marmot scrambled up the slope near by, then squatted in the entrance to his rocky den and looked over the world with infinite patience.

Then a movement in a green meadow just below me caught my eye, and I stiffened to alert attention as an elk came out of the shadow of a pine and began grazing. I caught other small movements, then discerned other shapes obscured in the shadow of the forest edge, and to my amazement I became aware of a whole herd of elk resting in the shade. They were mostly cows and calves, although I made out the outlines of a spike bull, with velvet antlers, in among the trees. It was the season of plenty and the animals lay about in green vegetation in all attitudes of relaxation and comfort.

Another cow arose and slowly wandered out in the meadow, where she picked daintily at the grass. Presently several more joined her, until the meadow was dotted with feeding elk. A calf, getting into the spirit of the occasion, trotted up to its mother and nudging her boisterously, readily found the well-known fountain of good things for calves, while its mother nonchalantly went on chewing. Soon the lazy animals began to lie down again, the calves almost disappearing in the tall grass.

It was a satisfying picture, a green wilderness meadow, dotted with sleek, red-coated elk, oblivious of danger, only concerned with their utter well-being in the season of plenty. A bright spot in the memories of the wilderness traveler.

I could mention numerous such occasions, the bright side of elk life, and incidentally a high type of human enjoyment of wildlife.

The winter presents another aspect. But lest we get the notion that winter is all hardship, let me refer to another incident.



One of the greatest thrills for a visitor to the high summer range of Jackson Hole is to come upon a big bull elk in his proper environment



(Left) The baby elk huddles close to the ground and remains motionless when its mother leaves it in order to find food

(Below) During the season of abundant food, the bull elk grows his mighty antlers. During this time they are covered with fur that is known as velvet



After the antlers of the bull are hard, early in the fall, the animals indulge in playful sparring, which is preliminary to the more serious contests that take place during the mating season



(Below) The summer range of the elk is a glorious succession of forested ridges and valleys interspersed with mountain meadows

Bureau of Biological Survey



I was snowshoeing in the foothills of southern Jackson Hole, tracking a coyote to see what it had been up to during the night. On one slope I found an exciting snow record of its chase of a jack rabbit, the long leaps, the desperate dodging of the quarry, the violent turmoil of bloody snow, then the long, orderly line of coyote tracks, with an occasional red spot in the snow.

FOOD BENEATH THE SNOW

Topping a rise, I came suddenly in view of a group of elk on another slope before me. Some were feeding, but most of them were lying down in a picturesque clump of aspens. The entire hillside was pitted with the elk diggings, where, as I later found, they had pawed down through the snow to a depth of at least thirty inches. Here they must dig for every mouthful, a miserable existence, one would think. Yet this, too, was a picture of contentment. Possibly the elk were not fully aware of the beauty of the winter landscape, the delicate tracery of aspen shadows on the snow, the ghostlike, snowy Tetons across the valley, but certainly they were a part of this picture of well-being. It was not an occasion of misery. One must judge the situation from the standpoint of elk hardihood and ability and ecological fitness. The elk did not mind digging for their dinner provided the dinner was there, under the snow, and had not previously been grazed off or cut for hay.

Yet another incident. It was nearing the end of the hunting season, about the middle of November as I recall it. Two of my friends had waited until that time to go elk hunting, with the idea that the colder weather would insure keeping the meat in good condition. I was invited to go along, and as I could combine the task of supplying the larder with the opportunity of obtaining a specimen for study, I went. As there were many hunters in the field, I was urged to appear at the ranch home of one of my friends at some outlandish hour before daylight in order that we might have a chance. I do not recall just what the alarm clock complication was, but when I arrived at the ranch all was dark and silent; but my saddle horse was there, tied to the fence, all saddled and ready to go, a mute invitation,

"Go and hunt if you wish, we couldn't wait and lose our last chance for an elk this year."

I got on the horse, and went, heading for the murky foothills showing in the darkness. A fine snow was falling. Presently the gray light of dawn pervaded the snowy atmosphere, and I could see horse tracks in the road I was following. As I entered the rolling hills, I saw more tracks. I passed a tent or two, where hunters were busy at breakfast — someone rising even later than I. By this time there were many tracks — evidently many others realized that only two more days of the elk season remained.

It was daylight by now, with intermittent flurries of snow. Two horse tracks led off across an opening in the woods, and I followed, idly wondering if my friends had gone there.

As I worked my way through the woods, seeking the open meadows, I had glimpses of elk, shadowy shapes disappearing in the timber. Occasionally I heard distant shooting. I came out on an open knoll and spied two horsemen below me, wearing flaming red caps. Just to pass the time of day, I turned in their direction, and as I came nearer I recognized my two friends, who stared in surprise at seeing me.

It is not my purpose to describe the details of the hunt, least of all the dying struggles of the elk. We did get elk, after a delightful roaming over snowy hills and through pine woods and aspens. We had fleeting glimpses of brown bodies through the trees, heard calves squealing in the distance. Then, on the top of a wooded hill, we came on a band of them. One of my companions left us to follow doggedly the trail of a wounded animal, which took him the rest of the day, while the other two of us fastened ropes to the necks of the elk we had shot. With a half hitch over the muzzle, and with a loop at the other end thrown over the saddle horn, we "snaked" them out over the snow, all the way down into the valley.

I wish to point out that the killing of the elk did not measure our enjoyment of the hunt. We were after elk, to be sure, and wanted to get them — meat hunters, if you please. But none of us get a thrill from shooting game, it is too easy. Our enjoy-



Photo by Norman McClintock

A Band of Elk in Winter

After the snows have come, the elk gather in large bands, and usually settle down for the winter in a rather restricted range. As the season advances, the bulls shed their antlers

ment of this hunt consisted of the exhilarating sting of flying snow, the slow flush of dawn, snowy woods, the creak of saddle leather, glimpses of fleeing elk, something of the excitement of seeking, of *wanting* a wild animal. In short, we enjoyed a little of the flavor of *wilderness*.

Space does not permit recounting the numerous experiences with elk that are enjoyed in the Jackson Hole country. Each summer eastern vacationists come into the valley, and some of these procure pack trains and wander into the mountains, enjoying the wilderness landscapes, the elk, moose, deer, and lesser wood folk, and the exquisite sense of seclusion and primitiveness. Naturalists come in to enjoy the fauna and the flora, which is still largely unmodified by artificial conditions. Local dude ranches send their guests into the mountains, and residents of Jackson Hole enjoy the various phases of the out-of-doors as opportunity and inclination permit.

In the fall the hunters come. In the earlier part of the season, chiefly, come the trophy hunters, who generally go back in the mountains for more or less extended camping trips. Later, when the weather is colder and when the elk come down and are more available, meat hunters are more numerous, although even then many hunters seek a trophy as well as the meat.

KILLING IN LARGE NUMBERS

During the fall of 1934 a special effort was made to effect a large kill of elk. With that end in view a portion of the Teton Game Preserve, that part lying east of Pacific Creek, where hunting of elk is easy and where they can be obtained before leaving their summer range, was opened to hunting. In view of the interest aroused over this action and the comment that has ensued, it may be worth while to enumerate some of the facts and their implications.

When the season opened, hunters flocked to the hunting grounds. Various hunting camps were established by outfitters, with guides available, some of these within easy reach of the highway. As the season advanced and the elk came lower, hunting could be done from a car, by driving to the vicinity of elk crossings. As the elk came

south through the mountains along the east side of Jackson Hole, other areas became favorite hunting grounds.

Efficient checking stations where hunters are required to report their kill have been maintained by the Forest Service and State Game and Fish Commission on the various highways leading out of Jackson Hole. As this is being written the records of game reports have not been fully compiled, and the local kill must be estimated in any event. Preliminary figures, however, indicate that the total kill of elk in Jackson Hole will be well over 3000.

THE WEAKNESS OF THE SYSTEM

Many who have witnessed the progress of the hunt are dissatisfied. Some complain that the hunting was too easy. Along a certain stretch of country paralleling the highway along Buffalo Fork, it was reported that fifty or more elk carcasses were found, some entire, others with the hind quarters removed, or in various degrees of abandonment. And of course there were the usual number of cripples that escaped.

One observer told me, in disgust, that a hunter drove in with a moose permit, got his moose the same day, and either that night or next day was on his way. Another complained that 150 bull moose will have been taken out of this general area this year — too many, he thought, and these include some which have in the past delighted tourists along the highway. It is claimed that the hunting on the game preserve drove the elk from very favorable summer and fall range north of the Buffalo Fork, and hastened their migration southward to winter range which is already short because of the drought and which should have been saved until as late a date as possible. This was a possibility that I pointed out last winter when the opening of the preserve was discussed. Yet in all fairness it should be mentioned that this year there was an unusually early migration, or "shifting" of the elk, many appearing at low elevations even in the summer, possibly owing to the premature drying up of portions of the high summer ranges. This tendency toward an early migration may well be a factor in the partial abandonment

of fall ranges coincident with the hunting. It is a situation, nevertheless, well worth considering in the future.

Apparently there has been comparatively little law violation. Some cow moose were shot, mistaken for elk, and some elk were shot illegally. The warden service is excellent and in game cases convictions are usually obtained. It is my opinion that poaching is no longer a major problem in Jackson Hole.

REDUCTION OF THE HERD

No doubt there have been abuses of the hunting privilege. Unethical practices probably have occurred. While some of the law violations have been in the nature of mistakes, inexcusable of course, but still mistakes, others almost certainly were vicious in character. Probably some mistakes have been made by the game authorities, although it is my opinion that in spite of certain mistakes, the hunting in recent years has been well handled. It is not my purpose to gloss over abuses. But if we view the situation in a broad way, and with an eye to the future, it takes on a different aspect. Let us examine some of the features.

It may be objected that we are killing too many elk this year. I do not fully agree with some of the estimates of the present number of elk in the herd. Some estimates seem too high as a basis for management plans. I prefer to rely chiefly on the organized counts made from time to time. But after all, in the present instance this matter seems unimportant. We have a large herd, whatever the number may be. Even if the herd were temporarily cut in half, it would not be serious in my opinion. Numbers can be controlled by controlling hunting, as the situation demands. We have had a series of drought years, and this summer even parts of the summer range became very dry, and the feed is short everywhere. Far better to reduce the herd temporarily, in whatever degree that may be attained in an orderly manner, than to injure the range further, and permit the suffering due to food shortage in the winter.

The meat hunter is often derided. He is only after *meat*, not after *sport*.

Let us examine this question for a mo-

ment. No doubt each hunter thinks he is getting sport in getting his elk, whether he be a hunter who spends much money and time on a lengthy pack trip, or one who merely steps out of his car to shoot his elk.

I was standing on a rocky ridge one day, taking motion pictures of a band of elk. They filed past me and disappeared down the slope. A moment later I heard a shot down below. Going over to a point, I looked down and saw a car on the road that wound up this narrow valley, and on the slope above the car a group of people, apparently a family, with several children, was busy dressing out an elk. Easy hunting, to be sure.

I must admit that a hunt from an automobile does not appeal to me as much as a long wilderness experience, and I believe we should strive for the highest type of hunting, weaving into the event all the esthetic elements we can achieve. Yet we have the practical matter of disposing of a given number of animals in a limited area. Most hunting areas today are limited, considering the number of hunters. It is useless to argue that we should so manage the areas that all hunters are forced to go into the back country with pack horses to hunt. In the first place, many times this is unfair to the man of moderate means. It means that he cannot hunt. Then, too, such a procedure would probably destroy the very thing we are striving for. A crowded wilderness is no longer a wilderness—it has magically vanished.

THE HUNTERS

After all, can we legislate or “manage” sportsmanship into the hunters? Impossible. Even the trophy hunter, who spends much money on a long trip, perhaps making it an excuse for an out-door debauch, may be infinitely less a sportsman than he who buys his local license and modestly drives out in his car to get his winter's meat.

After all, when local residents take some of the surplus game and use the meat, that is a legitimate use, and the meat becomes a local economic asset.

The values of wildlife have been stressed so much in recent years and have become so well known, that it seems trite even to men-



During the time when snow is on the ground, the problem of food becomes acute, especially since the encroachment of civilization upon the present range of the elk. Today the elk are unable to spread out over the flats which were included in their former territory, and perforce are congested in a comparatively small area. This is an unnatural condition and introduces the problem of artificial feeding





The elk become more or less indifferent to mankind and to human habitations during the winter, because of the necessity which has bottled them up in Jackson Hole. In this region snows begin early and last well into the spring, but the elk is well equipped by nature for a hard winter provided he can obtain food

Alarm

During the summer, the elk forget the winter's contact with man and are alert to any intrusion. If one elk discovers an enemy, the alarm is quickly conveyed to the whole band, which flees in a body

*Photographs by
Bureau of Biological
Survey*



Flight



tion them. The commercial value of wildlife no longer needs advertising. Indeed, in true American style, we may be overdoing it. In our zeal to capitalize on the financial values, we are in danger of killing the goose that lays the golden egg, by too much development and resulting destruction of primitive charm of sport. Aside from the financial aspect, the recreational values, from the human standpoint, which I consider the greatest of all, include such activities as hunting in the fall, wilderness camping summer and fall, the sport of outdoor photography, and observation by nature enthusiasts. Not the least of its values, by any means, are the scientific aspects. We should be willing to admit that we have not solved all problems of natural history in this generation, but should pass on to other generations an unimpaired field for study. Finally, and I think we are inclined to forget this important aspect, we have in the domineering human a trace of generosity toward wild creatures, a growing desire to save them *for their own sake*. From the purely human standpoint, this is admirable, and it deserves encouragement.

I have here been speaking of *wildlife*. After all, the elk are only an item in the larger, greater picture before us. I submit, that the elk, stripped of its environment, its associated flora and fauna, its wilderness, so to speak, has lost most of its value for us.

THE NEED

I have reserved for the last, when space is short, the most important problem confronting us. This is not how many elk shall we kill this year, but where can they live? Snows are piling up in the mountains. The elk are down once more, to find the foothills and valley devastated by drought, overgrazed, or with the vegetation harvested and stacked. Even the swamp could be partly harvested and grazed in the past dry summer. Only limited areas are left for elk grazing. The inevitable conflict with harassed ranchers has begun, and the overworked wardens are busy trying to adjust difficulties.

I shall depart from Jackson Hole for a moment, and take a countrywide viewpoint. As a matter of fact, Jackson Hole is in the lead in many respects. We have here become aware of the great value of primitiveness, the frontier. Thanks to the Forest Service, Teton National Forest has in the past been administered so as to preserve the wilderness to a great extent. State authorities and local sentiment have contributed their share toward this end. Nevertheless, we have our serious game-range problem. And it is a general problem throughout the country. What will we do about it?

THE REQUIREMENTS

From the standpoint of community welfare, recreation and hunting, if viewed only from the commercial angle, represent an industry involving millions of dollars annually. It probably ranks with any other local industry, in the majority of communities, or could be made to do so. It is no longer a minor by-product.

We used to feel, "Well, if there is any land left over, we'll let it be for the game." And we have set aside the rough, high country, which can't be used for anything else. Then we find a winter range problem.

Do we expect to carry this enormous national business without any investment whatever? How much *good* land have we given to wildlife? We give them the leavings, then wonder and worry over our game problems of malnutrition and diseases, and try to patch and fuss. Are we, after all, giving the elk a "dirty deal"?

We have public domain, we have submarginal lands. I think we have the opportunities. Also, I think we have a better understanding. We have already awakened to the needs of the waterfowl, and the Biological Survey is energetically pushing a hopeful program of marsh restoration and possibilities for our big game. The vital thing to remember is that our herbivores require lowland winter ranges, wilderness recreation requires a wilderness, and wilderness requires space.

The Dodo of Mauritius

For more than two hundred years the dodo has been extinct. Its story is essentially tragic, despite the humor its name so often seems to suggest

BY DOROTHY L. EDWARDS

THERE are numerous birds notable for their beauty, some are outstanding for their astuteness, but few can claim the ability to amuse as one of their most prominent qualities. In the latter classification, among birds existing today, the penguin perhaps ranks first. A possible rival for this honor, unfortunately, many years ago passed into the realm of "extinct birds," but its very name causes people to smile, and visitors looking at a museum representation of one seldom fail to derive vast amusement from it. This bird is the dodo.

Although the dodo is in itself amusing, its history is tragic. Before the year 1598 the dodo lived a peaceful existence in the forests of a small island off the west coast of Madagascar. A large, unwieldy, and flightless bird, it apparently had no natural enemies to fear, and the fact that it was slow of comprehension as well as of movement was no great detriment to its survival.

At the close of the Sixteenth Century the arrival of a Dutch sailing vessel at this virgin island was at once the first step in making the dodo known to the world and the first step in causing its eventual extinction. An expeditionary party under the leadership of Jacob Cornelius Van Neck coming upon the small island uninhabited by humans, took possession and named it Mauritius. The Dutch sailors were delighted with the abundance of wild life which made the procuring of food an easy matter. The dodo, looking fat and juicy, naturally fell a victim to the culinary scouts, who soon found it was possible to kill the heavy birds by the simple and primitive method of clubbing them over the head. However, the bird did not prove especially palatable to Van Neck's men. As long as succulent turtle doves were to be had in sufficient quantity, the dodo was not too popular for its own good.

Several years after Van Neck's visit to

Mauritius, another Dutch company stopped at the island, and again dodos were described as part of the native game. In 1602 a third visiting party reported finding the dodos and apparently mastered the art of cooking them more tastefully than did Van Neck's men, for at this point they were enthusiastically mentioned as food. Three or four birds furnished an ample meal for the whole crew.

Mauritius was colonized in 1644, and it was not long before the easily preyed upon dodo diminished drastically in number. Furthermore, the hogs, dogs, and cats that the newcomers imported found dodo eggs a tasty repast, and thus helped along the destruction. It is certain that well before 1700, less than a century after its discovery, the dodo of Mauritius had passed into extinction. Meanwhile the same fate had befallen two other species of dodo that had been found on neighboring islands.

Fortunately a number of artists were inspired to portray the dodo both in drawing and in color, and from these pictures, together with written descriptions and skeletal remains, we have our present-day knowledge of the bird.

Even after its extinction the persecution of the ill-fated creature was not over. A stuffed specimen had found its way to the Ashmolean collection at Oxford. Some years ago the officials of the institution, in taking inventory, came across it, decided it looked shabby, and ordered it burned, saving only the head and right foot. This order was carried out — thus destroying the only complete dodo specimen in existence!

Since that time various reconstructions of dodos have been made. One of these, which was prepared in the taxidermy studios of Rowland Ward in London, was presented by Mr. Walter Winans to the American Museum of Natural History, where it may be seen today in the Flying Bird Hall, together with a restored skeleton. Sedately amusing, it stands on exhibit, apparently proud to keep alive the memory of its vanished kind.

*A bird of another age,
the dodo of Mauritius.
This species (Didus
ineptus) had dark, ash-
colored plumage, with
a whitish breast and
tail, and yellowish-
white wings. Two other
species (Didus borbon-
icus and Pezophaps
solitarius) lived on
neighboring islands,
but all three became ex-
tinct at about the same
time, more than two
hundred years ago*





Below the Border

A naturalist's visit to the rugged country near Durango, Mexico, five hundred miles or so, as the airplane flies, west and south of Brownsville, Texas

BY ALFRED M. BAILEY

Director, The Chicago Academy of Sciences

Photographs by the Author

THE Rio Grande winding toward the Gulf has long been the dividing line between the attainable and the unattainable. The grass has always seemed greener, the mountains higher, and the people more interesting in that region beyond our border. Picturesque Mexican generals, doing and dying for no apparent reason, set their country apart from ours and emphasized the fact that theirs was a foreign land — a place of romance and adventure — but accomplished little toward making the region available to visitors. In years past many naturalists have combed the inaccessible places, it is true; they were hardy, experienced explorers, with time and ability to push to out-of-the-way spots. Now, however, it is possible for timid souls with less natural ability to make jaunts into primitive country and out again in a few weeks' time. Formerly it was necessary to keep close to the main routes of travel, unless well equipped for long overland journeys. but now, with the advent of sky

trails cutting the blue, it is possible to visit almost any section in a few days.

These routes, with planes flying on regular schedule, now offer quick transportation. I liked the enthusiasm of the agent of the Corporacion Aeronautica de Transportes at Brownsville, as we were looking over one of the little red Lockheeds, prior to the hop to the westward, for he was explaining the advantages of these trim flying ships over the larger ones used in the southern routes to Mexico City and southward. They made faster time, he said, could be landed in smaller fields, and as they were of light construction, in comparison with the heavier ships, would allow the passengers to break through the sides when the plane crashed, instead of their being caught in the wreckage and burned!

The planes leave Brownsville early in the morning, circle over the city, and then head to the southwest, high over the winding Rio Grande. The terrain is leveled by the height of the plane, and the thorny

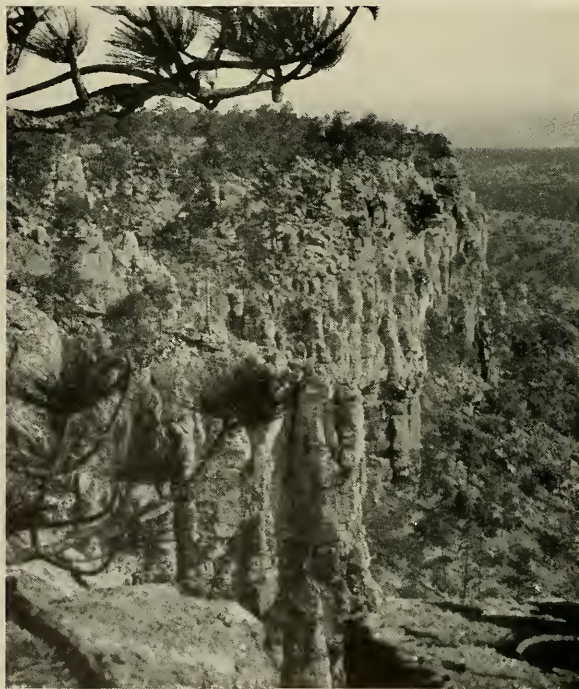
Small dobe villages are scattered over the near-by treeless mesas, where the natives from the surrounding hills occasionally come with burro-loads of grain, charcoal, or wood, to barter for a few necessities of life

(Below) The making of charcoal is the major industry of the natives dwelling in the hill country. Small camps are scattered throughout the wooded regions where the natives secure suitable hardwood. Logs are cut to a convenient length and up-ended, and after the fire has been started, the core is covered with ashes to control the burning





(Above) Along the valley of the Rio Tunal are groves of the prickly tunal, cactus plants which assume treelike proportions. Near Durango the river flows placidly through rounded, sterile hills, but upstream the mountain-sides are precipitous, and the stream turbulent where it rushes between upright walls



(Left) The Rio San Juan has cut a deep valley through the mesa, and it was along these steep cliffs that Mr. Bailey found the Montezuma quail feeding upon fallen pine cones. Ravens and white-throated swifts cruised rapidly along the walls, while hawks of several species were encountered in the pines



The patient burro is the peon's best friend

(Right) The Rio Chico flows through sparsely wooded hills and joins the San Juan

(Below) The ancient caravan trail was cut by the hoofs of countless pack animals through a whitish stone which the natives called "caliche"



scrub trees which offer impenetrable barriers to one on foot, appear as velvet carpets, while roads are ribbons of brown meandering across the level surface. Monterey, with its smoking chimneys, is only a short flight, and then it is not long before one is headed over rugged ranges and wide open spaces clothed with cactus. The town of Torreon, one of the important cities of central Mexico, is a transfer point; the plane from the east arrives at the siesta hour when everything is closed but the "American Bar," so it is necessary to wait patiently for the plane to be overhauled.

We were bound for Durango, the capital of the mountainous state of the same name, where we expected to make a short trip afield into the picturesque canyon and pine forests.

DURANGO

The plane circled abruptly, skirting precipitous rugged ranges where ravens flew along the upright walls, and though they were headed in our direction, they appeared to be flying backward. From jagged crests which seemed within arm's reach, we passed over a level plateau where there were cultivated fields of great symmetry, and where the air became extremely bumpy. And then the gleaming city of Durango with its flat-topped houses and garden-grown patios came into view; the plane banked abruptly and pointed downward to a gentle landing.

What can be said of this Spanish city of 40,000 people, founded by Don Hernan Cortez some four centuries ago? Situated in the foothills at nearly 7000 feet altitude, it has a delightful climate. It is Old World in appearance, and has not had a rush of tourist traffic to spoil it for those who delight in out-of-the-way places. A beautiful old cathedral with mellow chimes overlooks the tree-grown plaza, where young people come to stroll when dusk settles over the hills, and music of old Spain, probably by radio from Mexico City, comes softly from one of the near-by buildings.

Durango was founded when rumor came to Cortez's receptive ear that in the northern reaches of Mexico was to be found a mountain of gold. What hardships must

have been endured by the Spaniards as they trekked over the rough country, searching for the pot at the end of the rainbow — only to find a mountain of iron, which, so we were told, is one of the geological wonders of the world.

There are many old buildings to remind one of the early explorers, including an ancient old shrine upon a barren hill overlooking the city. For generations penitents climbed the steep slopes on hands and knees, kissing the ground as they progressed.

But our interests were in the wide open spaces. Mr. W. E. Brock and his kind wife offered their hospitality and arranged for our caravan animals. In a day's time we were afield astride mules, Mr. Brock, Boardman Conover, W. F. Ardis, and I, while a few pack animals in care of peons trailed behind. Ours was a combination pleasure and business jaunt; our excuse was to appraise a bit of timber, our purpose was to have a good time, and our course was up the Rio Tunal, a turbulent little stream which has cut deep gorges through solid rock. Vermilion flycatchers, perched in the bright sun, looked like gaudy flowers until they fluttered in the air to capture some swift-flying insect, and the rattling cry of small Texas kingfishers rang through the canyons. On the sterile slopes were masses of cacti and tall yucca-like growths ten or more feet in height with spikelike flowers, which seemed to be the favorite skulking places of curved-billed thrashers. We often heard the birds scolding in the depths of the tangle, where there was no chance of obtaining a glimpse of them.

SIERRA DE LOS CASTILLOS

At dusk we arrived at the junction of two streams — the Rio Chico which comes from the northwest, and the Rio San Juan from the south. We found our tents already in place, in charge of two Americans who had preceded us on the day before. Joe Green and Shorty Christiansen were a couple of punchers who had wandered south from the Rio Grande country, and were stranded. They had chosen a camp site near a large warm spring under tall cliffs of columnar formation, the picturesque escarpments being known, appropriately

enough, as the Sierra de los Castillos.

It is not difficult to find excuses for lingering in such country. Montezuma quail, the clowns of the family, flushed from underfoot when we climbed along the high ridges, and surely it was justifiable to loiter, hoping to find what the birds were feeding upon. Flocks of thick-billed parrots flying overhead in wedge-shaped formation called to us, and beautiful jays hung about the camps of the charcoal burners, probably because they obtained an easy living there. There were few Indians in this region, and they were extremely poor, as most of them had lost their cattle and horses during the countless quarrels of various Mexican generals. Those we encountered were suspicious of us, and usually urged their horses along at a rapid trot, the women folks edging to the far side of the trail. In wide parks in the beautiful pine lands we occasionally jumped a deer, and turkey tracks showed that these fine birds were numerous, if we cared to take the trouble to hunt them. We did want a pair so that we might determine the race which inhabited that particular area; so one day we sent a camp follower ahead to secure them for us the following morning. We gave him instructions to shoot a male and a female, and to keep them in good condition.

THE VALLEY OF THE TURKEYS

We were on the trail shortly after sunrise. Following along the edge of an escarpment, we saw many birds of prey, including red-tailed, sparrow, and goshawks, and one Oaxaco horned owl. All were remarkably tame, probably because they were rarely molested. We finally descended into a broad valley known locally as *Bajia de los coconos* — "the valley of the turkeys," and we had not traveled far along the caravan trail before we encountered our hunter, the Indian, sitting on a rock, kicking his sandalled heels and grinning amiably, while alongside him, stretched out in the shadows, were two magnificent turkeys — both carefully plucked! Not even a tail feather remained to guide us in an identification.

We camped this particular evening in a clump of sad pine, their long needles drooping disconsolately, near a series of

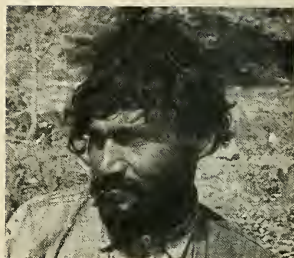
small springs. The water from these crystal pools ran in small rivulets and formed a marshy area which the natives called *Ciénega Tableterro* — "the marsh of the board-cutter." Here we found a delightful spot to linger and enjoy our work of timber cruising, for there were many species of birds with which we were unfamiliar, and when we found ourselves puffing from steep climbs, we could always find an excuse to pause and watch some little stranger in a near-by tangle. But it was in the dead grass of our little marsh that we found what all naturalists seek — an undescribed race — and we were not even on a collecting trip.

A NEW GENUS

A half dozen small birds unknown to us were continually flying about, and Mr. Broek asked embarrassing questions concerning their identity, so in self-defense, we borrowed the cook's gun and collected one of each. In company with striped sparrows were several little dark finches somewhat like savannah sparrows, which, we found later, were not only unnamed but of a new genus. (Named by the late Outram Bangs — *Xenospiza baileyi* — *Proceedings of the New England Zoological Club*. Vol. xxii, pp. 85-88.)

Days wandering in the hill country, feasting upon wild turkey and venison cannot last forever, so our course gradually led toward Durango. We skirted precipitous escarpments of the San Juan, where swifts darted along the crests, and then gradually dropped below the pine belt to a treeless plateau with great yuccas standing sentinel-like against the sky line. As we reached settled areas, the hillsides were clothed with groves of cacti and huge maguey plants. A small fruit grows on the former, and the native drink *pulque* is obtained from the latter. When the tall, flowering spike of this plant breaks into bloom, it is dug from the center of the plant, and sap forms in the cavity for a few days. This is non-intoxicating at first, and is known as *aqua de miel*, but when nature takes its course, a beverage of considerable potency results.

West of Durango towers the Sierra Madre, making a journey across country to the Pacific a matter of a week's caravan



A tousled-headed charcoal burner

(Left) Indians encountered along the trail were timid and uncommunicative, the women being exceedingly shy

(Below) The camp followers gathered about their little fire where they prepared their meals. They were a jovial lot when by themselves, and passed the time telling stories of revolutions of an earlier day





The tent usually was pitched amid a cluster of pines, where there was protection from the noonday sun. The inquisitive little burros seemed to enjoy human companionship, for they gathered near

(Right) The camp's turkey hunter was a picturesque fellow. He knew the ways of the wily turkey and had no difficulty in calling a band of birds within shooting range



(Below) Wide sombreros were worn by the natives of the hill country





Durango, the capital of the mountainous state of the same name, stretched below the plane, the white-washed walls of the buildings gleaming in the light. As the plane circled low over the city, those aboard could see the wall-enclosed gardens, the ancient cathedral, and the Plaza and streets teeming with people

The old cathedral with its twin spires faces the Plaza, its mellow bells lending enchantment to the twilight hours. As dusk approaches, band concerts are given, and the people, young and old, promenade among the tropical plants

trip over difficult trails. Our plans called for a short survey of Mazatlan on the Gulf of California, and so, instead of following routes which called for time and energy, we boarded a Lockheed at Durango late one evening and climbed rapidly into the west. The great tableland was cut by myriads of canyons which formed isolated flat-topped mesas; the canyons and the majority of the level areas were in dark shadow, with only an occasional rim rock still bathed in light. We crossed small camps, and saw a railroad winding far below. In half an hour we were well over the Sierra Madre, with great gorges and canyons below, while off to the south the ridges gradually faded away, their crests purple in the soft light. The Pacific was a band of silver below the clouds to the west as we reached 13,000 feet to clear the hills. Mists now hung over many of the canyons, and to the northwest the mountains were masses of shadow, the deep valleys being visible because the shadows were heavier. The sun gradually sank into the Pacific, blurred by small masses of crimson-tipped clouds. We lost altitude and gradually the shore line became visible in the fast fading rays. Then the lights of Mazatlan appeared as we circled lower and headed for a level area in the scrub growth about two miles away.

A TROPICAL COAST

The region bordering the Gulf of California is another world, just one hour's journey from the rugged country we had been working. Tropical birds of many species and varied hues are found in the thorny scrub which forms almost impenetrable tangles, while out over the water were many

sea fowl cruising about in search of food. The naturalist has no difficulty in finding things of interest in almost any region, but the country near Mazatlan proved to have a wealth of material from which to choose. The town is well worth visiting; it is a tropical city with Old World architecture. The market place was filled with products of the field and animals of the farms and sea. Parrots and paraquets screamed from cages and merchants squabbled over prospective sales.

A CONFISCATED CAMERA

We lingered in this hospitable region as long as we dared. Conover found it necessary to investigate one area; Ardis another; while Brock frankly admitted his work was finished but that there was no hurry about going home. However, planes are like time and tide. We had to go when we could get seats, so early one morning we were ready for the start. Buzzards flew from a feast alongside the field when the propeller whirled. A stalwart government officer had been looking me over, as I stood with motion camera over my shoulder, and I could tell I was guilty of something or other. Finally he stalked over — it was evident he was John Law — and demanded to see what I carried. The Eyemo was produced and he proceeded to confiscate it in the name of the Mexican Republic, declaring it against military regulations to carry cameras in planes.

"But, señor," I said, in my best Spanish, "you can't take my camera."

"But, mister," he replied, in his best American, "I have!"

And it was many a long day before I saw my camera again.

George Dupont Pratt

1867-1935

BY MADISON GRANT

Trustee, American Museum

NATURALLY endowed with a deep interest in Nature, and sincerely willing, throughout his life, to play his part to the utmost in the interests of conservation and education, George D. Pratt, from the time he became a trustee of the American Museum in 1921 until his death on January 20, 1935, was most active in furthering the work of the institution.

His interests were of extraordinary breadth, but he always seemed able, despite his many duties, to give his sincere and personal attention to all of them. Perhaps we of the American Museum felt that our institution held one of the principal places in his heart, for his gifts and contributions were both numerous and great. Yet other institutions and organizations may, with good reason, consider that his interests lay with them at least to an equal degree.

He was vice-president and trustee of Pratt Institute, which was founded by his father, and probably no other institution occupied exactly the same place in his mind. Nevertheless, his wide interests included the Boy Scouts of America, Amherst College, of which he was an alumnus, the Metropolitan Museum of New York, the American Forestry Association, the New York Zoological Society, where he was a member of the Board of Trustees, the American Federation of Arts, the American Association of Museums, and others still, and in many of these he occupied official, and always influential and active positions.

It is, however, principally his connection with the American Museum with which we are concerned here. So varied were his activities in its behalf that many times the space available would still be too little in which to cover them adequately. His generosity was exceptional, his gifts to the endowment fund alone totalling \$100,000, and these particular gifts splendidly illustrate his broadmindedness and his keen appreciation of the practical problems con-

fronting the Museum. When, in 1923, an effort was being made to raise a \$2,000,000 endowment fund, Mr. Pratt informed the president of the Museum that it was his intention to make a bequest of \$50,000 in his will, but that he was willing to make a contribution of this amount immediately if it was so desired, for he appreciated the fact that the income from this sum would be of real service to the Museum in trying times. His generosity in this respect was further emphasized by the fact that he contributed an additional \$50,000 in 1930 to the Sixtieth Anniversary Endowment Fund, although his previous contributions had fulfilled completely any personal obligations in this respect.

In addition to his contributions to the endowment, however, his numerous smaller gifts, presented for various purposes in which he was interested, added considerably to this amount. Nor was his generosity shown merely in financial support. Valuable paintings, motion pictures, Japanese prints, archaeological specimens, together with other specimens in many categories all came to the Museum as a result of his wide interests and his generosity.

He was just as generous with his time, as well, and during his years of service as a trustee he served on many committees — the Executive Committee, the Auditing Committee, the Conservation Committee, the Committee on Insect Life, the Pension Board and others, while his aid to the Committee on Education, because of his deep interest in the subject, was of exceptional value.

Nor was his interest in the Museum confined only to the time he gave to it. On one occasion, for instance, when he was on a recreational cruise to Norway, he obtained an exquisite series of wood carvings made by the Lapps, and realizing their value to the department of education, presented them to the Museum on his return.



GEORGE DUPONT PRATT
1867-1935

A trustee of the American Museum, 1921-1935

In addition to his interest in the institutions with which he was associated he gathered together a private collection of real merit. As a result of this he was often in contact with importers from whom he obtained many rare pieces. In this way he obtained for the American Museum an unusual collection of prehistoric Peruvian material, consisting of pottery, figurines, and other objects. In the same manner he purchased an exquisite collection of Javanese masks.

Many motion picture films that have demonstrated their educational value beyond doubt came to the Museum in much the same way, and so great was his sense of appreciation when his attention was called to such matters that the films he obtained cover an extraordinary breadth of subject matter.

His major interests, perhaps, so far as the American Museum was concerned, were education and conservation. His interest in conservation was of long standing, and from 1915 to 1921 he served as the Commissioner of Conservation of the State of New York. Thus, in this matter as in others, he was both widely informed and practical in his ideas.

As a result of the deep sincerity of his interests, therefore, he played so exceptionally important a part that his death cannot fail to leave a mark. His invariable willingness to assist in the solution of any problem that was brought to his attention was undoubtedly the principal trait that made him so valuable to the institutions he so generously supported. In his death, all of them have suffered an irremediable loss.

Science in the Field and in the Laboratory

American Museum Activities, Expeditions, Education, Meetings of Societies, and New Members

Edited by A. KATHERINE BERGER

To Study Native Animals of Hispaniola

An expedition to study the strange reptiles and rare animals that inhabit the island of Hispaniola is to be sent to the West Indies by the American Museum of Natural History.

The expedition will be headed by William G. Hassler of the department of herpetology. It will leave New York on March 14th aboard the "Pastores" of the Colombian line. The island of Hispaniola includes Haiti and the Dominican Republic.

One particularly interesting phase of the expedition will be the study of the rhinoceros iguana, which live on a tiny coral island off the coast of Haiti.

It is said that these massive and grotesque creatures are cannibalistic to the point of exterminating themselves, for reports indicate that no young individuals are found,—only a race of hoary old patriarchs apparently living on their own progeny! The life of a newly hatched rhinoceros iguana must be precarious indeed. And among the things the American Museum Expedition hopes to discover is how the females hide their eggs.

From the sea, the expedition plans to explore the interior of Hispaniola which, with its extremes in climatic conditions, its lowlands and its high mountains, still offers vast unexplored areas. Moreover, it has been constantly yielding up new kinds of animals. Many of these have very confined territories. Thus, it is certain that more new things will be found in the wet mountains, the hidden valleys, the deserts and the savanna-lands, when these are penetrated. The expedition plans to work in the most promising and least known of these very regions.

To Colombia for Insects

Research Associate Herbert F. Schwarz of the American Museum, and Mr. E. I. Huntington went to Colombia in the interest of the department of entomology of the American Museum. Mr. Schwarz is in charge of its collection of bees, wasps, and their relatives. Mr. Huntingdon specializes in butterflies. Both of these volunteer workers have already made several very successful trips to the American tropics in behalf of this Museum. The present expedition is certain to add much to the Museum collections and to knowledge of South American insect life.

Ellsworth Antarctic Expedition

A radiogram dated February 1 from Lincoln Ellsworth aboard the "Wyatt Earp" was received by Dr. Chester A. Reeds through the *New York Times*, informing him that five boxes of fossils and Nordenskjöld relics from Snowhill Island were being shipped from Montevideo to the American Museum. These will be placed on exhibit with other material gathered by Doctor Ellsworth on his polar expeditions.

March Program, American Museum Educational Activities

The following lectures are announced for March by the department of education of the American Museum:

1. Lectures For Members (Alternate Thursdays at 8:15 P.M.)
March 14 "A New Dinosaur Kingdom," by Barnum Brown
March 28 "Camping in the Canadian Rockies," by Frank R. Oastler
2. Nature Stories for Children of Members (Alternate Saturdays at 10:30 A.M.)
March 2 "Nanook of the North," Introduced by George H. Sherwood
March 16 "Mool, a New Guinea Boy Hunter," by Margaret Mead
March 30 "Just Out-of-Doors" by Paul B. Mann
3. Know Your Museum Series (For Members) (Alternate Tuesdays at 8:15 P.M.) by Herbert P. Whitlock
March 5 "Jade: Its Carving, Mythology and Symbolism"
March 19 "The Drummond Collection: Section of Antique Jade"

On the evening of February 8, the department of education entertained members of the United Parents Associations of New York City, Inc. On this occasion parents of school children of the city were shown the educational facilities of the Museum, and various kinds of school aids were exhibited so that the parents might have a clearer understanding of what the Museum's school service is doing for their children.

Under the auspices of the United Parents Associations of New York City, the department of education will give a series of five radio talks over Station WNYC on Friday afternoons in March, from 5:15 to 5:30 P.M. These broadcasts will emphasize the relation of the Museum to the school, the child, and the parent.

On Tuesday evening, February 19, the department of education entertained some fifty prominent educators of the city, including the district superintendents and representatives from several colleges in the city. An informal dinner was followed by brief

addresses by Doctor Sherwood and Doctor Granger, and then a short tour of Museum halls was made.

In addition to the regular Wednesday afternoon concerts in the Museum auditorium by the New York Civic Orchestra, free concerts by the Greenwich Sinfonietta are being given on Sundays at 2 P.M.

The time of the meetings of the Thoreau Nature Club for children has been changed from Saturday afternoons to the second and fourth Thursdays at 7:30 P.M.

The Hayden Planetarium

The Zeiss Projection Planetarium instrument has arrived in New York from Germany. It has been removed from the docks to a fireproof warehouse, where it now awaits its installation in the planetarium building when that building is completed.

The most interesting development in the work on the planetarium building during the month of February has been the placing of the first stainless steel plates on the inside of the dome. These steel plates are perforated with small holes in order to improve acoustics. A circular plate is first attached to the exact center of the dome and then the others radiate out and down from it. When completed, the stainless steel is painted white and the perforations become invisible.

The Amateur Astronomers Association

During March the Amateur Astronomers Association plans to carry on its regular radio programs on Tuesday afternoons from 3:30 to 3:45 over Station WOR. The schedule is as follows:

March 5 Miss Dorothy Bennett, "Meteors"
March 12 Mr. Arthur Draper, "Famous Meteorites"
March 19 Mr. Herbert H. Wilbur
March 26 Mr. James C. Hickey

The Amateur Astronomers Association announces that at 8:15 P.M. on March 6 and March 20 Dr. E. E. Free will give the first two in a series of three talks on "Astronomy and Astrology." His subject for March 6 will be "How and Where Astronomy Began: Hours and Days Among the Sumerians of 6000 Years Ago." On March 20 his subject will be "The Great Days of Astrology: When Star Watchers Were the Best Advisers in Economics."

The Junior Astronomy Club

The Junior Astronomy Club activities include lectures as follows:

March 2 "Mercury," Hugh S. Rice
March 16 "Origin of the Solar System," Dorothy Schoof
March 30 Motion Pictures, Elections

Weekly radio program on Saturdays at 4:30 P.M. over WINS:

March 2 "Spring Constellations," Lois Saphir
March 9 "The Earth, a Measuring Rod," Alfred Alk
March 16 "First Magnitude Star," Helen Kuchuk
March 23 "Dramatic Sketch on Galileo," Hubert Bernhard and others
March 30 "Pluto," Hubert Bernhard

The club publications, the "Handbook of the Heavens" and the *Junior Astronomy News*, carry the club's message into almost all the states of the union.

South American Indian Material for the American Museum

Dr. Harvey Bassler has presented to the department of anthropology a large and complete ethnological collection from Northeast Peru. Many years of travel in this jungle country on the eastern slope of the Andes brought Doctor Bassler into contact with about fifty Indian tribes who still inhabit this region. The main body of the collection comes from the Chama Indians, although the Jivaro, Witoto, Boro, Schinaku, and many others are well represented.

While there are many unique specimens in the collection, the great value lies in its completeness. Every phase of Indian life is represented, not just the more artistic or the unusual. In this collection we find the infinite variety of the potter's art, weaving from spindle through loom to finished cloth, the total contents of an Indian house. Here are the weapons of the hunter and warrior, stone clubs, bows with poison-tipped arrows, spears, traps, and the typical blow guns. At the same time we find the children's toys, counterparts of their fathers' weapons, such as small bows, darts, and reed blow-guns, with which they play at fighting and hunting. The collection gives us a picture of what the Chama Indians wear. Their costumes for every day use are accompanied by the elaborate masks, bark cloth and grass skirts of the dance. Every variety of seed, shell, nut, tooth, and bone bead is represented. Ear plugs, lip plugs, wristlets, feather headdresses, fur caps, stuffed bird ornaments, and bamboo splint combs show the adornment of the Indian. If we are interested in the music we can examine the musical bows, the variety of bamboo and bone flutes, and the leather-headed and wooden drums. The ramifications of design can be studied in the painted vessels, the decorated cloth, the carved wooden paddles, and in many small designed objects.

It is not possible to list the total variety of the collection. Fortunately most of the specimens have already been studied and illustrated in two books by Günter Tessmann, *Die Indianer Nordost-Perus* (Hamburg, 1930) and *Menschen ohne Gott* (Stuttgart, 1928), which were published under the supervision of Doctor Bassler. This collection represents the finest picture of a modern South American Indian community that the Museum possesses.

Tropical Plants

With the recent dismantling of the tropical greenhouse in Central Park, the laboratory of experimental biology at the American Museum has acquired a large series of valuable plants. There are many

ferns, epiphytes, and rapid growing vines, which have been installed in the greenhouses of the Museum. The gift also included a series of tree ferns, two palm trees, and several banana plants. These tropical plants will be of great assistance in stabilizing the moisture content of the greenhouses. They will also be available for temporary installation in the exhibition halls on the occasion of special demonstrations.

Tropical Fish

Mr. John H. Phipps has recently presented a collection of live tropical fish to the laboratory of experimental biology at the American Museum. These will be available for various physiological studies being carried forward at the present time by several members of the laboratory staff. Mr. E. A. Candidus, who recently was elected president of the New York Aquarium Society, has also cooperated in the studies on living fish. He has presented a series of valuable specimens and has also given much of his time toward properly installing them in tanks.

A Subtropical Fish Visits Newfoundland Coast

Through the kindness of Mr. Ernest Ingersoll, the department of fishes of the American Museum has received a dried filefish (*Alutera scripta*), about six inches long over all, from Stone's Cove, Fortune Bay, south coast of Newfoundland, which was sent for determination to the *Family Herald and Weekly Star* of Montreal, and mentioned in the issue of that paper for December 19, 1934. The specimen is interesting because this is a sluggish, mostly West Indian fish, which drifts in the currents, and its occurrence so far to the northeast shows how widely warm subtropical water must have been spread in the western Atlantic in the fall of 1934. Mrs. Henry Miller writes us from Stone's Cove that "it was hauled into a herring seine while hauling small herring for bait. The date was Sept. 25, 1934." — J. T. N.

American Game Conference

The twenty-first annual meeting of the American Game Conference was held in New York on Jan. 21, 22, and 23. Several members of the staff of the American Museum attended sessions, which were of interest to conservationists and to those interested in mammal and bird problems.

Dr. H. E. Anthony attended, during this period, a meeting of the Federal Elk Commission as a member of one of the subcommittees of that body. The increase in numbers of the Northern Yellowstone elk herd beyond the capacity of the available range has made it necessary to adopt drastic measures in order to bring the numbers into harmony with conditions as they exist. The National Park Service has proposed, as a last resort, the killing of a certain number of these animals after the hunting season

has taken its toll, and it was the consensus of opinion at the meeting of the Federal Elk Commission that this plan was constructive and should be endorsed.

At the close of the Conference the Resolutions Committee reported. During the Conference one of the important issues was the duck shortage throughout most of the States where these birds are shot, a matter of much concern, and it was hoped by many that a resolution would be offered which recognized the shortage as a disturbing element. The conservationists even hoped that the Conference would go on record to advocate a season of no shooting at all. However, this issue was avoided by an expression of confidence in the U. S. Biological Survey, in whose hands the whole problem was placed. An independent resolution offered from the floor calling for a closed season failed to carry.

Imperial Mammoths

Professor Osborn is preparing for NATURAL HISTORY another article drawn from his great monograph on the Proboscidea, which is now on the American Museum press after twenty-seven years of preparation. The Imperial Mammoths of the United States and Mexico represent the culmination of a long line of descent and of migration which is traced back to South Africa through discoveries in Saskatchewan, in the Pliocene Siwaliks of India, various parts of the old kingdom of Austria, in southern France, northeast England, north Africa, and then by a great leap to the earliest known ancestors through discoveries of grinding teeth in the terraces of the Vaal River valley of South Africa. Most generously Director Wilman of the McGregor Museum in Kimberley, South Africa, has made a temporary loan of six specimens of the most interesting types of Proboscidea that have ever been discovered; these grinding teeth reveal in the most convincing manner a heretofore theoretic transition between the simple-crested mastodon type of molar and the multiple-crested primitive molar of *Archidiskodon*, a genus which derives its name from Greek words signifying archaic-disked-tooth. Along the Vaal River terraces in Pliocene time lived the small ancestors of the Imperial Mammoths, about the size of a baby elephant, with extremely simple mastodon-like grinding teeth.

Great Imperial Mammoths grew from these small South African forest- and river-border-dwellers.

The evolution and migration of this transcendent branch of the African proboscidean stocks migrated northward and reached southern Europe in Upper Pliocene time. On the southeast coast of England it was associated with the Piltdown man, *Eoanthropus*. Most remarkable is the fact that these Imperial Mammoths entirely disappeared in Europe and, traversing Asia and the Bering Strait land bridge, passed through Saskatchewan into Nebraska in Early Pleistocene time, where they flourished in

great herds. Finally, during Late Pleistocene time they advanced southward into Mexico and became extinct before the final Ice Age.

Honors

At the second Pan American Conference of Eugenics and Homiculture which convened in Buenos Aires, Argentine Republic, November 23-25, 1934, Prof. Henry Fairfield Osborn, together with Major Leonard Darwin and Prof. Charles P. Davenport, was unanimously elected honorary president.

Appointments

Members of the American Museum as well as the Scientific Staff will be delighted to learn of the appointment of Prof. Othenio Abel, lately Rektor of the University of Vienna, to the professorship of

geology and paleontology in the University of Göttingen and directorship of the Geological and Paleontological Institute and Museum. Professor Abel is known in America not only by his brilliantly written popular volumes covering the whole field of vertebrate paleontology, but also as a most welcome visitor to the western fossil fields of the United States about ten years ago. — H.F.O.

Bird Paintings

An unusual collection of paintings depicting the shore birds of South Carolina, birds of wood and rice fields, and warblers of eastern North America, was on exhibition in Education Hall of the American Museum from December 17 to 29. The artist is Edward von Siebold Dingle, of Middleburg Plantation, South Carolina.

Recently Elected Members of the American Museum

The membership department lists the following persons as having been recently elected members of the American Museum:

Annual Members

Mesdames PAUL ACHELLS, L. C. LEEDS, ARTHUR L. ZERDEY. *Messrs.* DAVID G. ACKERMAN, HOWARD L. HASTINGS, ROBERT D. HOLBROOK, HUGH KNOWLTON, GEORGE ROCKER, CHARLES T. SIBLEY, THOMAS A. YAWKEY, J. S. ZINSER.

Associate Members

Mesdames JOHN MOSELEY ABBOT, ELEANOR B. ACKERMAN, EVELYN W. ADAMS, M. A. ARMSTRONG, L. K. BARTLETT, HELEN L. BECKER, ROBERT S. BICKLEY, HELEN N. BLANCHARD, ADOLPHE BOISSEVAIN, J. E. BRANTLY, WALTER BRESLAY, DWIGHT L. BROWN, WALLACE MURDOCH CAMPBELL, JAMES L. CARRICK, JEAN CARROLL, MARION F. CHAMBERLIN, A. TREESSE CHRISTOPHER, ANNA M. COLE, MARGARET M. COMANS, FRANCES H. CONSALUS, PERSIS M. COPE, WALDO E. CUMMER, DANIEL R. DAVIS, DOROTHEA DIPRETO, AUGUSTA DICKINSON, C. S. DICKERSON, AUGUSTUS VAN HORNE ELLIS, E. P. ELLWOOD, RICHARD D. ELY, M. W. ENSIGN, JOSEPHINE M. FABRICANT, DINAH FRIEDLAND, J. F. GUTHRIE, CHARLES A. HAMELY, CHARLES H. HAMPTON, H. B. HARSHEY, MICHAEL HEIDELBERGER, B. HOLLAND, WALTER HUBER, J. W. HUGER, J. E. INGRAM, H. E. JEWETT, ALFRED G. KAT, FLOYD E. KEIR, HAZEL E. KEIRSTEAD, JOSEPH A. KELLY, S. W. KIRKON, EDGAR A. KNAPP, CHARLES J. KNUDSEN, ETHEL E. LARSEN, WALTER B. LASHAR, F. H. LOWELL, ROBERT HARDIN MAY, ALFRED G. MAYOR, EDWARD A. MIDDLETON, GEORGE MOORE, ETHEL MORRISON, HENRY J. NEWMAN, GEORGE NOTMAN, MADGE OSBORNE, M. B. OWENS, W. W. PARKER, MORTON E. PECK, EMMA R. PIATT, OSCAR WENTWORTH PLACE, EMILY NOBLE PLENN, REYNOLDS POND, E. E. POTTBERG, GLENN S. REEVES, EARL E. SEABERG, THERESA SHALES, THOMAS E. SHARP, GEORGE SIMSON, JR., LILLIAN RUTH SPENCER, EMMA H. STILLERMAN, R. E. STRAWBRIDGE, JR., L. P. STRUGER, CHARLES H. TALCOTT, S. B. THELER, ALVINA TODD, WM. J. TUCKER, HANNA T. VOSPER, ELIZABETH H. WEEKS, HELEN B. WILSON, R. E. WOLF, J. H. WOOD.

Sisters M. LUKE GUDGER, MARY BERTHA.

Messes RAB ABRAHAM, ALICE A. ADANALIN, ELISABETH BASS, RUTH BEALS, LENA M. BEAR, GRACE GRIFFITH BEGER, LILLIAN B. BERGMAN, MAY L. BERING, ELIZABETH A. BILLINGS, HAZEL BLAIR, MARGARET BLOSSOM, ANNA C. BOWEN, HELEN R. BRAEM, EVA S. BROWNING, HELEN M. BUROES, JULIA R. BUSH, MARGARET E. CARLSON, FLORENCE L. CASE, EMMA L. CATEN, GERTRUDE CHANDLER, JUDITH CHURCHILL, EDITH ANN CLARKE, JOSEPHINE CLEARY, B. ELEANOR COLLINS, ANDREA A. COOK, ANNE E. COOK, AMELIA K. CONNELLON, NELLIE P. COVERT, ANNE DAGES, ANGELINE M. DEAN, BARBETTE DE CUREY, RUTH C. DEMUND, GRACE DENNY, GISELLA DIVISICH, SARAH G. EVANS, GERALDINE EWALD, PAUL L. FEISS, BERTHA S. FINKELSTEIN, BEULAH THORNTON FITZHUDD, CLARA FLEISCHAUER, ELSIE FREEDMAN, E. LENA GALLUP, IRENE P. GERHARDT, ESTHER M. R. GILBERT, RUTH GILLISPEE, CECILIA M. GROSSMAN, ELEANOR HAGGE, JENNIE HALL, MARIA CLEMENCIA HART, KATHRYN F. HANLEY, ANNE HARMON, CORRA HARRIS, MARY F. HAYES, MARIE A. HICKEY, HARRIET HINMAN, JENNIE

HIESHORN, SARA F. HOADLEY, MYRTLE E. HOFMANN, EVELYN HORN, HARRIETT HOLLMAN, ALICE H. HOOPER, FLORENCE E. HURER, ELIZABETH H. INNES, LEILA ISRAEL, GRACE E. JACKSON, MINA S. JACOBSEN, MANTHA JENKINS, MARIE L. KESEE, ROSE MARIE KIEFER, ALISON KIMBALL, AUGUSTA C. KRAMER, ANGELIQUE C. KROLL, CAROLINE E. LAWLOR, ANNIE R. LAWRIE, MARION L. LITTLE, ISABEL LOOMIS, FRIEDA LUBELLE, MARY K. LUCEY, HAZEL B. MACKELL, MARGARET C. MACKINTOSH, CONSTANCE G. MAHONEY, OPAL MAY McCLAREN, ELIZABETH McCONNELL, DELPHINE B. McCREADY, DORIS McDANIEL, REBY McDONALD, JOSEPHINE M. MERRILL, MILDRED Z. MOKUS, RUTH C. MOLYNEUX, ALMARINE MOORE, MARGARET MOORE, HELEN E. MORRIS, JENNIE D. MORSE, DOROTHY A. MOTT, NEVA MUNSON, MARY E. OCHSENHIRT, ESTHER C. OLSEN, MARJORIE ADA PARSONS, FLEDA PERRY, MATTIE JEAN PHELPS, RUTH L. PHILLIPS, PEARL FOPE, PAULINE PRIZAN, HALLIE E. QUEEN, CAMILLA M. RADOVICH, ELIZABETH S. RAWLINSON, POLLY ROBINSON, PEARL SALSBERY, EDITH F. SCAIFE, MARGARET A. SCHER, JANET M. SEISTER, MAUDE M. F. SHAFFER, LEAH SHEERWOOD, CECILE M. SHOKET, HATTIE SHY, JOAN BENTNICK SMITH, LEONA A. SMITH, ROSE STEINBAUDT, BEATRICE Z. STREETER, ANITA TARBELL, GERTRUDE M. TELL-KEY, JANE IEN BROECK, RETTA THOMAS, MELANIE THOMPSON, FREDERICK THREBETTS, ESTELLE TISCHLER, WILLIAMETTA TURNERSEED, EMMY R. TURNER, ELA MAE VANDERBOGT, MARY G. VAN MEETER, ELVERA E. VELTRI, G. OUIDA VORRIS, BESSIE M. WALLACE, ELIZABETH WALTER, FLORENCE S. WARD, MARIE L. WELDON, MARION WESCHLER, LOUISE WHITAKER, ELIZABETH WHITNEY, ELIN WIKANDER, JUNE E. WILLIS, GERTRUDE WOLFER, ANNIE LEE WRIGHT, NOLIA ELAINE WOOD, ANNA R. ZAGER.

Reverends JOHN C. CAREY, PATRICK F. DOYLE, WM. H. HUDNUT, JOHN J. McENARNEY, M. B. NASR, WALDEN PELL, 2d, HARVEY C. PORTER.

Major-General PRANCE CANTACUZENE
Brigadier-General JAY J. MORROW
Colonel TOWNSEND WHELEN

Lieutenant Colonel FRANK M. KENNEDY

Major LOUIS LEFFROY

Lieutenant FRANK J. VIDA

Doctors ABRAHAM J. ABELOFF, M. B. AHLBOERN, WILLIAM BREWSTER ALLAN, WILLIAM ANTOFOL, BENJAMIN APFELBERG, JOHN P. ARCIERI, EDDYTHE A. BACON, L. P. H. BAHRENBURG, R. P. BALL, JOSEPH BARDY, FRANK G. BASS, GEORGE L. BECKER, GEORGE BEEBE, GEORGE W. BELLANO, ABRAHAM J. BELIER, NORMAN C. BERRY, L. J. BERMAN, MAX BERMANKE, ERNST BISCHOFF, J. HUDSON BLATVELT, H. BORSIAW, W. H. DEBORN, C. CHARLES BURLINGAME, MARTYESTHER BURNS, JOHN D. BUTZNER, PLUMB BROWN, EDWARD J. CAMPBELL, JOSEPH I. CANTAROW, FRANK RILEY CASTLEMAN, FRED T. CAVANAUGH, DANIEL E. CHASE, ALBERT CLAUDE, S. A. COFFIN, SIDNEY CORN, J. DE R. COMBES, MARY E. CONRAD, ETHEL L. CORNELL, GEORGE S. COTTON, H. C. COWPER, GEORGE H. CROOKER, LOUIS ANTZIG, WILLIAM E. DAVIS, E. C. DAY, FREDERICK M. DEBORN, M. P. DE BOE, NICHOLAS H. D'GIANNI, CHARLES L. DICHTER, C. W. DEL PLAIN, M. DOWNEY, CECIL C. DUSTIN, LUCIEN Y. DYRENFORTH, L. F. ECKN, HERBERT ELFTMAN, DuMONT F. ELMENDORF, ALFRED C. EMMEL, JOSEPH ERDMAN, PAUL J. EWERHARDT, E. J. EYTINGE, LOUIS E. FAZEN, JULIUS FECHNER, W. G. FELCYN, GEORGE B. FERNLUND, JOHN P. FERRARA, OTHO A. FIEDLER, CHARLES D. FREEMAN, AMOS EDGAR FRIEND, LEWIS F. FRISSELL, JOHN GARDNER, WM. V. P. GARRETSO, H.

Reviews of New Books

Recent Publications for Those Interested in Nature

Adam's Ancestors. By L. S. B. Leakey. New York: Longmans, Green and Co. 1934.

THE hold title of this book indicates the general tenor of its contents. Written by a young East African archaeologist of English descent, who has had remarkable success in his home field researches, the volume bristles with new facts and new ideas, some of which may be expected to excite lively discussion.

It is impossible here to give the treatise its duly merited consideration on all points, but it is a handbook which seeks to present in summary fashion all the more prominent facts and interpretations regarding Paleolithic man and his culture. Accordingly, after dealing briefly with geological and paleontological questions, several chapters are devoted to physical anthropology, or rather osteology, with a view to demonstrating the opinion long held by Sir Arthur Keith that the modern racial type, *Homo sapiens*, is of much greater antiquity than has hitherto been generally believed. In support of this view, the author has found in East Africa certain jaw and skull fragments, associated with Chellean artifacts, which, with other hitherto disputed skeletal remains, would seem to prove that the famous Cromagnon man of European Aurignacian times was not the earliest physical representative of his type.

On the cultural side the author supplies a very interesting chapter on flint-working technique, based at least in large part on his own experimentations. He next gives a descriptive account of the successive Paleolithic flint industries, in which he brings together all the latest discoveries and observations by the Abbé Breuil of Paris. The chief outcome is that the Middle Paleolithic stage, generally regarded as embracing the Levalloisian and Mousterian industries, has been considerably expanded as to time duration and also as to differentiation in technique, the result being that among these flake industries a new phase known as the Clactonian has been recognized. The Levalloisian and Clactonian flake industries are regarded, on the one hand, as contemporary and as parental to the Mousterian industry, and on the other, as running back to Chellean times, thus paralleling the core industries represented by the coup-de-poing or hand-axe of Chellean and Acheulian characteristics. The suggestion is made that these contemporary but distinguishable flake and core industries are the products of different racial groups, the first belonging to the Neanderthal man, now extinct, and the second to the early ancestors of modern man.

The little book is written in readable, even at times

exuberant, style; and, barring portions of chapters 5 and 6, may be read with both profit and enjoyment by the layman. The specialist will doubtless take the author to task for his new definition of the Pleistocene, his opinions about man's relation to nature, the relation of bone to tissue, and especially his rather positive assertions on such subjects as, for example, patination. But taken as a whole the book is timely and well worth the specialist's consideration. — N. C. N.

Field Book of Insects. Third edition, rewritten to include much additional material, with about 800 illustrations, many in color. By Frank E. Lutz. New York: G. P. Putnam's Sons. 1935.

WHEN the first edition of the *Field Book* appeared, in 1918, a distinguished American entomologist, looking it over, exclaimed: "Why has this not been done before?" There were several good reasons why it had not been done. Most entomologists are specialists in some one or two orders, and feel disinclined or incompetent to discuss the others. There are indeed many who are teaching in the universities, and some of these write excellent text books, which survey the field from the standpoint of a laboratory instructor. Such texts largely fail to meet the needs of the amateur, who wants to know about each insect he finds, "What is it?" and "What does it do?"

It appeared to Doctor Lutz that we were living in a world full of beautiful and interesting things, capable of stimulating equally the æsthetic and intellectual faculties, and that to ignore all these marvels was to deprive ourselves of a great deal of pleasure which could be had practically without cost, and within a short distance of our homes. Indeed, with the *Field Book* and a fairly good garden, one could find employment for a year. An English amateur entomologist, S. T. Klein, was in his later years an invalid, confined to his couch, but he spent a great deal of time in his garden, and wrote a charming little book on his experiences there.

Doctor Lutz has on exhibition at the American Museum a collection from his garden in the vicinity of New York, and the number of species found is astonishing. Even such an unpromising locality as the paved court of the British Museum at Bloomsbury, London, furnished the entomologists of that institution with a considerable collection, including some rare species. They picked them up as they crossed the court on the way to and from their work.

The world of insects being thus literally at our feet, we can find in the *Field Book* a vast amount of information enabling us to learn something about

almost anything we may find. Emphasis should be laid on the fact that we ourselves can learn what we want to know, and are not obliged to run to an entomologist or send our specimens away in order to get the beginning of knowledge about them. It is better fun, and much more profitable in every way, to help ourselves. Later on, when we know more about the subject, it will be necessary to get other kinds of help.

For the butterflies, grasshoppers, dragon flies, and some other groups there are books which make it reasonably easy to determine the species, at least in the northeastern and central states. In the case of other groups, the books are still inadequate, and the young amateur may perhaps dream that he will be the one, some day, to smooth for others the rough path he has toiled over. When all is done, and we have for the United States such splendidly illustrated and complete works as Edmund Reitter's *Die Käfer des Deutschen Reiches*, the collector will have an easy time; but are there not some who would rather be the pioneers, living in the days of hard work and the discovery of new territories?

As I was preparing this review, there came to hand Dr. P. P. Calvert's account of E. B. Williamson, of Bluffton, Ohio. (*Entomological News*, January.) Williamson, banker, and student of dragon flies, was as fine a type of amateur as this country has ever produced. How can we produce others like him? Of the many thousands who have used or will use the Field Book, most will touch the subject rather lightly, and be drawn from it by other interests. But some, who have that urge which can be felt but cannot be adequately explained, will go further, and some of these will become leaders in the science. The college teacher, the worker in economic entomology, and the amateur are all necessary for the progress of entomology, but it is the amateur who especially ministers to that thing we vaguely call culture, which concerns itself with the development and enjoyment of our faculties rather than the struggle for existence.

— T. D. A. COCKERELL

Before the Dawn of History. By Charles R. Knight. Illustrated by the author. Whittlesby House, McGraw Hill Book Company, Inc., New York and London. \$2.50.

TO A human being the most interesting subject on earth, aside from himself, is other human beings. What are we? How did we come here? What are we doing, and Why? These are questions that command our immediate attention. And this is one of the secrets of the fascination Charles R. Knight has captured and bound in with his story, between the covers of *Before the Dawn of History*.

Preëminently an artist, anatomist, painter and sculptor of animals from the life, Mr. Knight has focused his unusual talents for many years upon the portrayal of Nature as he sees it, and that he sees it with truth and sincerity is witnessed by the fact that today he stands foremost among the animal painters

of his time. But not only living animals have claimed his study and work. Among his finest achievements are the series of murals in the American Museum of Natural History, showing reconstructions of prehistoric animals and man; and also a series of murals on the same subject painted for the Field Museum of Natural History. Accepted as authoritative, many of the paintings have become world-famous, and indeed, are familiar to almost every schoolboy and adult student of the history of man. These murals form the main theme of *Before the Dawn of History* and appear as a series of beautiful reproductions in brown halftone. Eight of the pictures included have never before been published.

To him who would go adventuring into the story of the past ages of the earth, and yet who is unable to see the original paintings and see them in their full beauty of color and imagery, there is no more delightful treat in store than to accept the invitation of *Before the Dawn of History* and go on an exploring expedition, with its text and its illustrations as traveling companions. I warrant he will come to the end of the book with a perspective on the history of life on this planet that will enable him to look with more understanding eyes upon the world-life of today, — an enlightenment that arches over the long expanse of the ages and binds together more surely day by day the innumerable fragments of evidence gathered by scientist, and artist, and thinker, throughout the years of man's history upon this earth.

On the inside front cover of the book a chart of geologic time sets the stage for the drama, and the story of the probable beginnings of the earth forms the Prologue. Then, step by step, but simply, in easily understood language, the artist-author proceeds to paint word pictures of the gradual appearance of life, as proved by fossil relics found all over the earth, from the first blue-green algae to the final masterpiece — man. Everything in its proper sequence, so that the whole panorama unrolls steadily before the mind's eye with a realism that grips the imagination to the point of making the reader feel that he is being permitted, for a brief time, to be a partaker of the actual experiences of the actors in the fight for survival and progress. One studies every detail, living the scene, and loath to go on to another, yet eager for the story.

The text throughout reveals the depth and breadth of the foundation of genius and knowledge upon which the artist was able to build so concretely. At every rereading one marvels afresh at the grasp of the subject it was necessary for him to possess before he could attempt to visualize the life of even a single age.

The experience of reconstructing these invaluable records of the living forms of ancient creatures and their surroundings must have been a remarkable one for Charles R. Knight. — A. K. BERGER.

Nature Education: A Selected Bibliography. By William Gould Vinall of the School of Education, Western Reserve University, 1935. 82 pages (Mimeographed).

NO ONE knows the value and the constant need of a well-selected list of nature books better than the members of the staff of a Museum of Natural History actively engaged in nature education. Earnest requests for the names of good books on every phase of natural history are being received continually.

We have here an excellent list of eighty-two type-written pages, prepared by one who has been engaged in the field of nature education for a quarter of a century. By his long experience as a teacher, and by his activity in camp work and other nature projects, the author is unusually well fitted to make the best selections. He himself is the author of a very helpful book, entitled *Nature Guiding*, which he has too modestly omitted from his bibliography.

The books are classified with cross references, so that it is very easy to locate the group in which one may be interested without looking through long lists.

The books are listed in nine general groups, within which are forty or fifty more specialized groups, such as — Indians, Camp Cookery, Handcraft, Plays and Pageants, Nature Poems, Dogs, Wild Flowers, — to mention only a few.

I have examined the list with some care, and find the names of very few books that I would have omitted, and I fail to find that there are many that I would like to see there. Doctor Vinall will have the gratitude of many teachers, parents, and nature leaders for this helpful booklist. — CLYDE FISHER.

Big Game Shooting in Africa. By Major H. C. Maydon, J. B. Lippincott Co., Philadelphia. 1932.

BIG Game Shooting in Africa by Major H. C. Maydon and other authorities was published by Lippincott in 1932, and hence a review at this time may seem rather tardy. However, it is a book of such importance and is so useful to the sportsman as a general or specific reference to Africa, that it deserves to be brought to the attention of those readers of NATURAL HISTORY who have not encountered it in its rather limited distribution.

The volume is divided into a series of parts which deal with general topics such as "Equipment," "Dangerous Game," and the major geographical areas typified by "Sudan," "Uganda," or "Somaland." The parts, in turn, are treated in chapters which go into all the useful details. This treatment is intended for sportsmen who may be planning a trip to Africa, but the data are equally useful for the traveler or student who wishes to become intimate with African big game.

A number of authorities have collaborated in preparing the book, and the list of writers includes many of the very best African names. The data are brought right up to date, and no sportsman or nature lover interested in Africa who has looked into the

pages of this book will want to do without it. For the department of mammals in the American Museum it is by all odds the most useful reference book in its field, and the one most often cited in answer to inquiries.

Despite the fact that the information it contains makes the volume encyclopedic in its scope, many will enjoy reading it for sheer enjoyment, as plenty of narrative is employed. Incidentally, it should, on occasion, be a boon to cross-word puzzlists, for it contains a number of native or vernacular names for mammals. No matter how "outlandish" an aggregation of letters the puzzle-maker can throw together, all too often he finds he can extricate himself by such a definition as "West African Antelopes." Many a letter and telephone message to the Museum is inspired by this pernicious habit!

The tyro is advised upon such important topics as his choice of guns and other equipment, the time of year in which to hunt, and the spot upon the animal at which to aim. Even experienced sportsmen, visiting Africa for the first time, will be glad to learn where to shoot an elephant, anatomically speaking. An elephant is a large target, but the lethal areas upon his carcass are not large, and it is well to know just where they are. He is an animal which does not respond well to experimentation along these lines, and his brain is not at all where one might think it would be.

A number of excellent photographs are included in the book. In the appendices one finds extracts from the game laws of different districts. — H. E. ANTHONY

New York Walk Book: Excursions afoot within a radius of fifty to one hundred and fifty miles of the City including forest trails in mountain regions; by Raymond H. Torrey, Frank Place and Robert L. Dickinson; new and revised edition; Dodd Mead and Company, New York. \$2.50
The Art of Walking: edited by Edwin Valentine Mitchell, Loring and Mussey. \$1.75

THE New York Walk Book has been written by three men who are outstandingly equipped to produce a volume that should be owned by everyone interested in New York City's out-of-door environment. The energetic triumvirate are to be heartily congratulated on their splendid accomplishment. With this book in hand, the reader will ever find a definite answer to the question, "Where shall we go walking?"

The new edition of the *Walk Book*, first issued by the American Geographical Society in 1923, is a compact, pocket-fitting volume of 332 pages. It is well indexed and has been revised to the extent that it is to all intents and purposes, a new book. Delightful pen and ink sketches, many of them panoramic profiles, are skillfully executed and help to substitute for contours missing from the colored maps.

The *New York Walk Book* tells, in a most satisfactory fashion, where to go, how to get there, what to see, and how to return. It is replete with well written, interesting natural history and human history in-

formation, intelligently selected and gracefully presented. There are footnotes telling of the origin of place names, the location of notable geological formations, and the significance of many historical sites. Numerous botanical and zoological accounts are also given. A carefully compiled bibliography enhances the value of the book.

In reading this guide, with the thought of its prospective usefulness foremost in mind, we naturally paused frequently to consider the public for whom the work is intended. We did not lose sight of the fact that there are two principal types of walkers; those with objectives in view and the ones who are objectiveless in their strolling.

We have encountered all sorts of foot travellers upon all kinds of trails. There are the ones who rush headlong through the forest, glassy-eyed, trying desperately to establish a record for the greatest number of miles covered in the shortest given time, seeing nothing and sensing less as they trot along. At the opposite end of the scale are the super-botanically-minded crawlers, who delay their companions by kneeling down every few minutes, to expound at learned length about the mosses, liverworts, or something else. Most satisfactory of all are the woods-wise individuals who combine the traits of leisurely but progressive walking with the "seeing eye."

The New York Walk Book may be safely recommended alike to the marathon runner, the all-absorbed and all-absorbing Rambler, and to the man, woman, or child who "just walks."

A different sort of "Walk Book" which might well be a companion to the above, is a thoughtfully gleaned collection of tramping essays, edited by Edwin Valentine Mitchell and called *The Art of Walking*. The anthology includes the writings of George Gissing, Christopher Morley, Hilaire Belloc, Charles Dickens, William Hazlitt, J. Brooks Atkinson, Max Beerbohm, George Macaulay Trevelyan, Teslie Stephens, and John Finley.

It can scarcely be claimed that all of these authors are qualified authorities on walking, nor do they claim to be. Max Beerbohm, for example, makes no bones about it when he holdly asserts, "It is a fact that not once in all my life have I gone out for a walk. I have been taken out for walks; but that is another matter. . . . When I grew up, it seemed to me that the one advantage of living in London was that nobody ever wanted me to come out for a walk." Surely here was no cross country expert!

Although a number of the collected writers are undoubtedly well versed in the manners of the trails and by-paths, — William Hazlitt and J. Brooks

Atkinson are two of these, — we nevertheless believe that a better title would have been, *The Art of Writing About Walks* rather than *The Art of Walking*.

Books of this nature are remarkable for their omissions or inclusions. We fully appreciate that, in the space of 128 well designed pages, it would be an impossible task to select and reprint everyone's favorite essay on the subject of walking. Regardless of this, we do miss, rather poignantly, the works of several time-tried authors whose volumes have often accompanied us afield.

Be this as it may, *The Art of Walking* is a decidedly worthwhile book to own and, had it appeared earlier, it might well have been listed on page 320 of the *New York Walk Book* under the heading, "Nucleus For A Trampler's Library." We were surprised that both the "Nucleus" and the "Art of Walking" omitted the name of Thoreau from their pages.

John Burroughs, ever an outstanding member of the "Order of Walkers" once wrote of Thoreau, "No other writer that I recall has set forth the Gospel of Walking so eloquently and so stimulatingly."

Inasmuch as we are in sympathy with Mr. Burroughs' opinion, we are interested to note that although Thoreau's name is not to be found in the table of contents, his works are frequently referred to in the essays of several of the authors represented. Perhaps this is one of the reasons that induced Mr. Mitchell to make the omission. We might add that John Burroughs himself, and John Muir are similarly among the missing in each book, and nowhere, in title, bibliography, or index do we find the name of that dean of walking essayists, William H. Hudson.

— W. H. CARR.

Recent American Museum Publications

AMERICAN MUSEUM NOVITATES

- No. 765. New Species of Nycteribiidae and Streblidae (Diptera). By C. H. Curran.
- No. 766. New Records of Bees. By T. D. A. Cockerell.
- No. 767. A New *Colias* from South Dakota (Lepidoptera: Pieridae). By Alexander B. Klots.
- No. 768. Two Partially Ambicolorate Flatfishes (Heterosomus) I. — A Summer Flounder, *Paralichthys dentatus*, II. — A Rusty Dab, *Limanda ferruginea*. By E. W. Gudger.
- No. 769. Mammals Collected in Kazakhstan, Central Asia, by the Morden-Graves North Asiatic Expedition, with the Description of a New Ground Squirrel. By G. G. Goodwin.
- No. 770. On a Pareiasaurian Reptile from South Africa, *Bradysaurus Whitii*. By Lieuwé D. Boonstra.
- No. 771. On Some South African Reptiles of the Suborder Therophalia Preserved in The American Museum of Natural History. By Lieuwé D. Boonstra.
- No. 772. On the South African Gorgonopsian Reptiles Preserved in The American Museum of Natural History. By Lieuwé D. Boonstra.
- No. 773. Two New Species of *Formica* from Western United States. By William Stead Creighton.
- No. 774. African Bees of the Genus *Gronoceras*. By T. D. A. Cockerell.
- No. 775. Early and Middle Tertiary Geology of the Gaiman Region, Chubut, Argentina. By George Gaylord Simpson.

NATURAL HISTORY

The Journal of the American Museum of Natural History

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NATURAL HISTORY — Publication Office, 10 Ferry Street, Concord, New Hampshire
Subscriptions should be addressed to 10 Ferry Street, Concord, N. H., or to The Treasurer, The American Museum of Natural History, 77th Street and Central Park West, New York, N. Y. NATURAL HISTORY is sent to all members of the American Museum as one of the privileges of membership, \$2.10 of the annual amount received from each membership being in payment of the year's subscription to the magazine. TOM DAVIN, Manager of Publications, Advertising Office, The American Museum of Natural History, 77th Street and Central Park West, New York, N. Y. Copyright, 1935, by The American Museum of Natural History, New York



Ewing Galloway

Aristocrats of Ethiopia

At least theoretically the hereditary ruler of Abyssinia is an absolute monarch. Actually, however, the power of the sovereign is considerably modified by the provincial chiefs. Nevertheless, the system has developed intense loyalty on the part of the people, who, perhaps because of this feudal-like system, are both proud and brave

(See "The Ethiopians and Their Stronghold," Page 286)

NATURAL HISTORY

April, 1935

Transplanting a Coral Reef

A description of the beautiful Bahaman Coral Reef Group soon to be opened at the American Museum

By ROY WALDO MINER

Curator, Living Invertebrates, American Museum

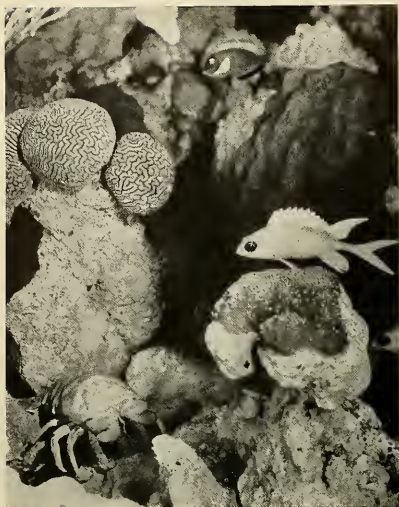
After twelve years of complicated and difficult work, the department of living invertebrates at the American Museum is about to open to the public what is, perhaps, the most remarkable museum "group" ever constructed. Created from forty tons of coral that was gathered from the sea bottom in the Bahamas, this elaborate exhibit is tied together and supported by an intricate fabric of structural steel which, in itself, weighs eight tons. In the course of the work, Doctor Miner, the author of the following article and the originator and designer of the exhibit, has led five expeditions to the Bahamas during which the studies and the collections utilized in building the group have been made. His account and description, therefore, are of special interest and value. — THE EDITORS

AS you enter the Hall of Ocean Life on the gallery level at the American Museum, the new Bahaman Coral Reef Group may be seen at the farther end directly opposite the observer. Its proscenium arch rises from the main floor of the hall, passes through the gallery, and surrounds the upper part of the group in a half-circle at a height of thirty-five feet.

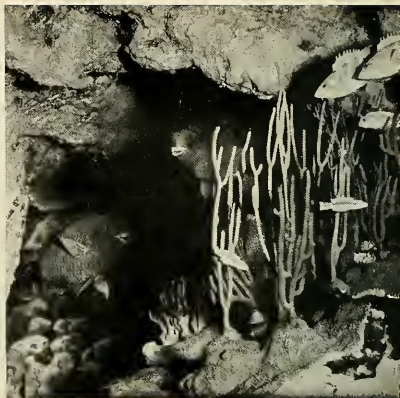
The portion of the group above the gallery presents a vista of coral island with waving palm trees, quiet lagoon, and tropical sky with trade-wind clouds drifting across it. A flight of flamingos dots the background of snowy clouds with flecks of rosy color. On the distant horizon, apparently a mile or so away, the low-lying shore of Andros is visible, soft with its long fringe of coconut palms. For the scene is laid in the Bahamas, along the eastern coast of its largest island mass, where the finest coral barrier reef in the West Indies parallels the shore. The small island in the foreground is Goat Cay, just back of the main reef, the location of which, at the left, may be seen more clearly, at closer view.

The section of the group below the gallery, even at this distance, obviously depicts the coral forest as seen from the bottom of the sea. On either side, staircases permit visitors to descend from the gallery, and, as it were, plunge beneath the waves to stand on the ocean floor and study the coral reef from that point of vantage, as the members of the Museum's expeditions did in obtaining the material and observations for this group.

Now let us pass around the gallery and view the upper scene at close range. We are looking over the rail of a yacht which has been anchored fore and aft in a channel of the reef. The wind-swept vegetation of Goat Cay and its shore of eroded limestone are now clearly visible. At the left, the dark blue waters of the Tongue of the Ocean, an arm of the sea more than a mile in depth, roll in, breaking heavily upon the barrier reef in long lines of white foam. The coral barrier rising from the crest of a submerged precipice, the summit of which is from twenty to forty feet below the water surface, consists largely of huge branching

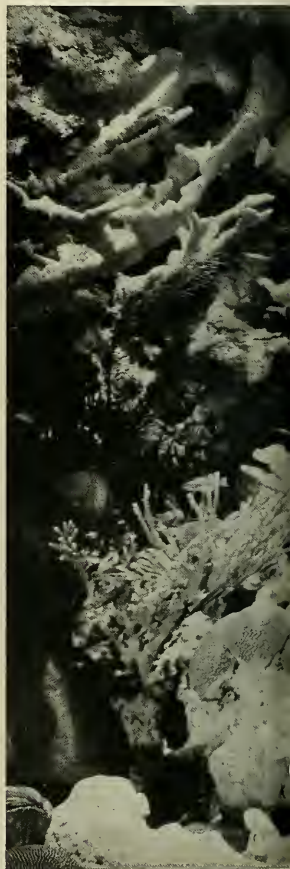
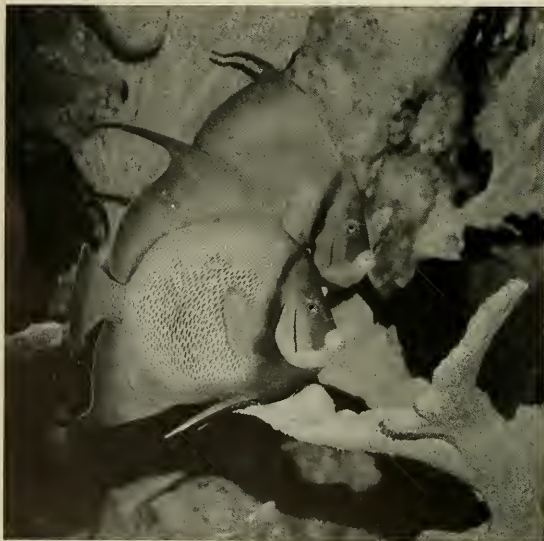


A squirrel-fish swims over a post of orb coral toward a triple-headed brain coral, below which crawls a bear-crab



(Above) The Cave of the Blue Parrot-fish guarded by its white-jawed denizens

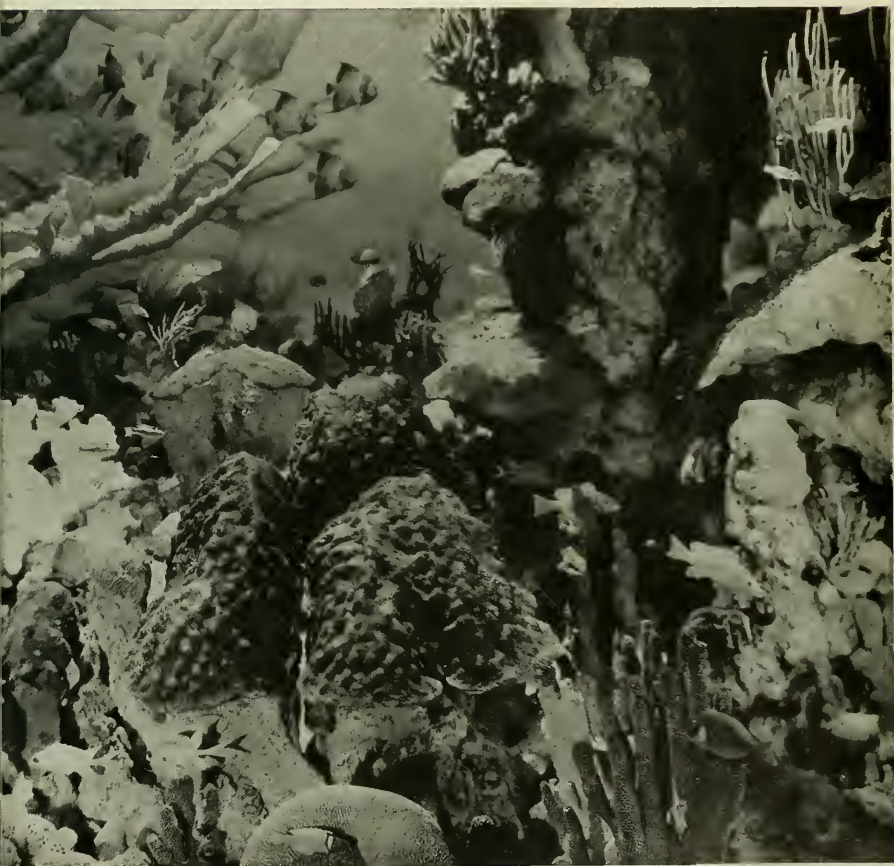
(Below) Two members of a school of black angel fish, with spadelike bodies, their dorsal fins with trailing filaments



*A spiny lobster
peers forth from
its den among the
corals, waving its
prickly antennae*



*A vista through branching
elkhorn corals. Black angel
fish swim by in stately
procession. In the fore-
ground is a group of three
mushroom-like orb corals*



trees of the elkhorn coral, the tips of which break the water surface at low tide. The trade winds, blowing continuously from the southeast, dash the waters of the Tongue of the Ocean against the face of the submarine precipice and the tangled growth of the stony coral trees, causing upwelling currents which mingle with the ranks of snowy-crested surf.

THE UPPER SCENE

Inside the reef the force of the waves is broken, and they slide with diminishing force in intersecting cross currents across the quiet waters of the sheltered lagoon, where vessels may lie safely at anchor, except in times of hurricane.

In the distance the shore of Andros shows native villages snuggling among the coconuts, while, at the right, the open waters of a wide strait, Middle Bight, lead the eye into the quiet peace of a broad inland sea, dotted with islands.

The towering trade-wind clouds rise on the heated air currents of a June day 25,000 feet into the air, where their fleecy summits stand out against the deep blue of the tropic sky. Outlined against them, the long file of scarlet flamingos flies in stately procession inland to follow the coast to the great flamingo colony in southern Andros.

Our boat is anchored close to a little rocky cay, a point of which projects in the right foreground, carved and honeycombed in fantastic hollows.

Looking over the rail, our eyes penetrate the transparent waters right down to the bottom of the sea, and, through their lucid depths the wondrous submarine gardens are disclosed with all their beauty of form and color, tempting us to a closer view.

So, descending the staircase, we pass beneath the gallery level, and well may we imagine that we have donned diving helmets and have penetrated the depths, for all the glory of the coral world bursts upon the view. We are gazing into the heart of a magnificent coral forest. The branching trees of the elkhorn coral (*Acropora palmata*) rise, tier on tier, above our heads, breaking the water-surface sixteen feet above. An arching sea cave at the right, piercing a fantastically carved and eroded

submarine ledge, leads into a tortuous tunnel filled with mysterious purple shadows and soft lights filtering through an opening in the rear. This is the Cave of the Blue Parrot-fishes, and two of the heavy-bodied cerulean tenants may be seen nosing their way out of the cavern entrance, while a third swims slowly back and forth as if guarding the back door.

Between the rocky wall and the spreading tangle of the coral forest a vista opens out into the watery world, melting by degrees into the opalescent and luminous blue mist which everywhere terminates our vision in the distance. The light of the sun filters through the aqueous depths, lighting up vague forms of grotesque outline. The waters in the Bahamas are of unbelievable transparency. Crystal clear in the foreground, everything stands out as sharply as in the open air. Under favorable circumstances, at depths ranging from fifteen to twenty-five feet, one can see a hundred feet or more before visual penetration is limited by the gathering density of the sun-lit azure fog.

The sea floor, around one's feet, blooms with every variety of stony splendor in crowded array. Not an inch is wasted. As far as the eye can see through the watery aisles the abundant coral growths stand in shouldering clusters. Here is a group of three green, dome-shaped caps rising close together on stony pedestals for all the world like giant mushrooms. They are the annular orb corals (*Orbicella annularis*), their green summits suffused with delicate clouds of rose, where areas of the tiny flower-like polyps show their expanded tentacles. Near by, a double-ridged brain coral (*Diploria cerebriiformis*), bright orange in color, projects its rounded knoblike head, mounted on a contorted column, its surface covered with complicated meandering sculpture, suggesting the convolutions of the human brain. A little farther to the left another growth of the same species has developed an odd triple cluster of heads upon the same stem. A beautiful elkhorn immediately behind it spreads an unusually symmetrical frond of broad palmate branches like a giant fan. Crowding upon this from the rear, phalanxes of orb coral



Nassau

Grouper

This great, striped and mottled fish is often so camouflaged among its surroundings as to be practically invisible. Should it swim over a patch of white sand, its colors fade to harmonize. Opposite the grouper a giant sea anemone spreads its waving tentacles. At the lower right is a fragile bush coral

posts stand, grouped like sentinels, among golden yellow nuggets of pore corals (*Porites astreoides*) which cover every available space on the sea floor between their stately neighbors.

In the center foreground, spreading clusters of the fragile, finely divided bush coral (*Acropora prolifera*) overarch the hiding place of the spiny lobster or crawfish (*Panulirus argus*), while on a little sandy patch at the lower left a bear-crab (*Scyllarides aquinoctialis*) is warily inspecting a large spiny sea urchin (*Centarchinus antillarum*) which radiates its black, needle-like spines in all directions, reminding one of a submarine porcupine. Clusters of yellow-tipped finger corals (*Porites clavaria*) are crowded at the base of a great dome of sidereal coral (*Siderastrea siderea*), most massive of all species. This particular specimen weighs a ton and a half, and, when collected, required the combined efforts of twelve men to roll it up the beach.

THE LAIR OF THE MORAY

Behind the finger corals arches a low cavern, the home of the dreaded green moray (*Gymnothorax funebris*), which inhabits crevices of this sort. It is a heavy-bodied eel with small head furnished with sharp, needle-like teeth. It is well for a diver not to thrust hand or foot into such a crevice without first investigating with a lance, for the creature will dart out its head, biting viciously at any intruder. The eroded coral forming the arch and sides of this cavern is overgrown with purple, green, and yellow sponges, some forming clusters of chimneys, others made up of low, rounded mounds crowded closely together.

Everywhere among the stony coral structures rise dense growths of gorgonians. These are the plantlike sea-bushes, sea whips, sea feathers, and sea fans. When one observes them through a glass-bottomed boat, one can see them wave back and forth with the ocean currents, and they are often mistaken for vegetation by the casual observer. Nevertheless, they are animal structures with a core built of horny material, instead of having a limy "skeleton," as with the reef-building corals. There are some gorgonians, known as

"sea clubs," with fully expanded polyps, shown in the group near the moray's den. The clubs are purple, but, when the light-green polyps are fully expanded, that color is concealed and the clusters appear to be masses of heavy, feathery plumes. When one touches them, however, the green polyps are suddenly withdrawn within the clubs, and the color seems to change into purple as if by magic.

The sea feathers (*Gorgonia acerosa*) are large, heavy, magenta-purple plumes reminding one of ostrich feathers. Many of them can be seen in the group. When fully expanded, the fine branchlets are covered with rows of tiny corn-yellow polyps suggesting the florets of goldenrod.

The sea fans (*Gorgonia flabellum*) are strikingly conspicuous on the reef. As their name implies, they are broad fanlike expansions, characterized by a lacy texture of fine meshes. Purple and yellow sea fans are seen growing side by side and are of the same species.

The fish-life of the coral reef is very abundant and characteristic. When, equipped with diving helmets, we wandered, half walking, half gliding, through the coral forests of Andros, or the sea gardens of Rose Island, we seemed to be in another planet, where trees were of tinted marble and grew with interlacing branches gnarled in weird contortions from a forest floor beset with enormous mushrooms, also of stone; where animal flowers expanded and contracted on every hand, and dim figures moved silently in dark, mysterious caverns. We ourselves glided almost as in a dream, for, though we wore helmets weighing sixty-five pounds in the world above, down here among the corals we seemed to have lost all weight, and, borne up by the aqueous medium, became part and parcel of our ethereal environment.

Then, suddenly, almost out from nothingness, our watery atmosphere became shot with living jewels, brilliant colors scintillated in the sunlight that came dancing down from the motile liquid silver film of the water surface above. Fishes of every hue were all about us. Chromids shone with sapphire, blueheads, — the males, true to their name, hooded with rich azure, col-

Transplanters of the Coral Reef. Doctor Miner conversing with Chris Olsen, chief modeler of the group. At left, Herman Mueller, glass modeler, Dr. George Childs, scientific artist; at right, Worthington Southwick, colorist, Bruce Brunner, assistant modeler



General view of the Coral Reef Group seen beneath the pontoons of the Lindbergh plane. (Above) the Coral Lagoon at Andros Island. (Below) view into the heart of the coral barrier from the sea floor



lared with black and snowy white, with bodies of a brilliant emerald-green; the females, with salmon-colored cheeks, their bodies green and white, with black stripes; the young, yellow like canary birds, often variegated with black blotches and areas of green and pink. As we wandered about, larger species sailed into view, gaudily decked out in gay patterns.

FISHES OF THE CORAL REEF

Let us return to our group, for here we have endeavored to give a similitude of life as faithfully as possible, though with a feeling of despair at the inadequacy of our efforts.

Many blueheads (*Thalassoma bifasciatum*), as described above, may be seen flitting about in various parts of the group, especially toward the right. The sergeant-majors or cock-eye pilots (*Abudefduf marginatus*), are the rather deep-bodied little fishes, with vertical black bars over a body shading from yellow to white, in the upper right-hand corner, near the top of the rocky ledge. They must not be confused with the banded butterfly-fishes (*Chatodon striatus*). These are thin, flat, and much smaller. They are seen as if flitting like butterflies, in the lower part of the group, to the right of the center, where they are associated with blueheads and slippery dicks (*Iridio bivittata*). These latter are little, elongate fishes, with a continuous fin along the back, their color blending through pale tints of rose, green, blue, and black markings on an orange and yellow ground.

The large fishes swimming in a school down past the upper portion of the cliff are yellowtails (*Ocyurus chrysurus*), so-called because they have a bright yellow stripe along the side of the body continued into a completely yellow tail. They are excellent foodfishes and are eaten throughout the West Indies.

An interesting situation is occurring in the upper part of the group. A school of houndfishes (*Tylosurus raphidoma*), conspicuous because of their slender, silvery bodies and long pointed beaks, is being broken up, the fishes scattering desperately through the coral branches. The reason is not far to seek. Lurking just under the

water-surface, at the upper left, and gliding through the coral branches, is a large barracuda (*Sphyræna barracuda*), four and one-half feet in length. Its baleful eyes are fixed on its prey as it slides swiftly toward them, the undershot jaw slightly open, showing an irregular assortment of long, cruel teeth. The barracuda are abundant in tropical waters, where they are dreaded even more than sharks. Fortunately, they seem to prefer open lagoons, and only occasionally visit the reefs.

In the middle distance, below the houndfishes, a large school of black angel fishes (*Pomacanthus arcuatus*) sails slowly by in stately procession. They are deep-bodied, dark gray in color, often with indefinite vertical bands, and with trailing filaments prolonging their large, flat, dorsal and anal fins. Compare them with the blue angel (*Angelichthys ciliaris*), a brilliantly blue, flat-bodied fish, in the middle part of the group, nibbling at a purple sea feather. The remarkable peacock blue of its body and fins is narrowly bordered with scarlet which shades into trailing, bright yellow filaments above and below. Near by, a school of yellow and black rock beauties (*Holacanthus tricolor*) flits in and out among the corals.

NATURE'S CAMOUFLAGE

Slightly to the left of the lower center, just behind a growth of the fragile bush coral, a large Nassau grouper has emerged halfway from under a coral arch. Its brown-and-tan striped and mottled color pattern acts as a camouflage with the variegated surroundings and so completely conceals it that one can gaze directly toward the fish for several minutes without noticing it, in spite of its size. The Nassau grouper is one of the prized foodfishes of the Bahamas, and the people of Nassau pride themselves on the savory chowders made from it. When exploring a reef with diving helmet, one should be wary of cornering one of these groupers, for when irritated, they are capable of suddenly turning and giving a vigorous nip. It is interesting to watch a grouper swim out over a patch of white sand. As it does so, the mottled color pattern fades out before one's eyes and the

fish becomes pale and sandy in color, completely harmonizing with its background. As it turns and goes into the reef again the color pattern returns with all its original vividness.

Around the grouper's arched hiding place, several clumps of the beautiful lettuce coral (*Agaricia agaricites*) are attached to the dead coral rock. They have beautifully foliated expansions in undulating clusters, richly tinted with rose-madder, pink, and purplish-blue, often with suggestions of yellow. On one of our trips, our artists made careful color sketches of these corals in the living state. Then the specimens were collected, bleached, and brought back to the Museum, where the color was restored artificially in oils. On a subsequent expedition, we carried samples of these painted corals back with us, took them down undersea, and placed them on the reef, beside living specimens. We were greatly gratified to find that the artists had copied the colors so faithfully that they could not be told apart when viewed at arm's length.

CORAL GARDENS

Almost directly opposite the nose of the grouper, a beautiful red-tipped sea anemone (*Condylactis gigantea*) of large size expands its cream-colored, petal-like tentacles above a scarlet body. The sea anemones are closely related to coral polyps, but, unlike them, are incapable of building a stony skeleton.

At the extreme right of the group, a series of great domelike heads of brain coral (*Mæandra*) and purple sidereal coral (*Siderastrea*) rise in a clustered terrace of massive outline. Among them tower post-like pinnacles of tree-stump coral (*Dendrogyra cylindrus*), with meandriform patterns completely covering their shafts. Butterfly fishes flutter about, their light delicacy in strong contrast to the massive rotundity of the coral heads.

The loosely branching antlers of staghorn coral (*Acropora cervicornis*) grow out from the narrow crevices between the heads, their sharp points menacing like *chevaux-de-frise*. Immediately before one's eyes, the striking color pattern and unbelievable form of the

queen trigger fish (*Balistes vetula*) startle the gaze of the onlooker. Various individuals are differently colored, but all are equally surprising.

STARTLING COLOR COMBINATIONS

The most brilliant combination starts with velvety bright green on the upper part, shading into equally bright purple below. The lower part of the face may be pink or yellow, and two extraordinarily brilliant blue streaks are slashed across the face. Radiating irregular lines of black outlined with cream dart in all directions like lightning streaks from the very bright eyes with their little, black, beadlike pupils. The body of the fish is so narrow that when it turns toward you it seems almost to disappear. Its little, absurdly puckered mouth is furnished with white, close-set teeth. The fish is not shy, but will swim directly up to your helmet and peer in at you, moving its pursed up mouth as if it were trying to kiss you. If you try to grab at it with your hands you find it always just beyond your grasp.

Above it is another surprise, — a fish that we often see nosing about the reef, always singly. It is the equally absurd trumpet fish (*Aulostomus maculatus*). It grows to a yard or more in length, and is equipped with a ridiculous elongated snout, flattened vertically with a small mouth at the extreme end which is always in motion. It has a pulled-out caricature of a horselike face with small eyes set far back. The paired fins are very small, — almost insignificant, but the vertical dorsal and anal fins are broad and set so far back on the body as to seem about to slide off on to the fan-shaped almost arrow-headed tail. The color-pattern is quite as surprising. It is faintly suggestive of a Scotch plaid, being composed of vertical brown bands crossing longitudinal yellow stripes at right angles, against a light tan background. Small black dots are sprinkled over this array in longitudinal rows. As the fish progresses, it may expand its mouth like a trumpet, or the whole snout will droop in elephantine fashion. Sometimes it swims nearly upright, with head either up or down.

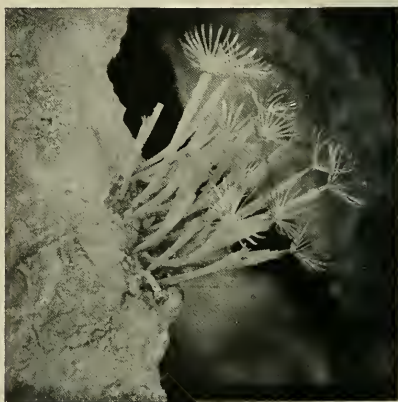
It is refreshing to turn from this out-

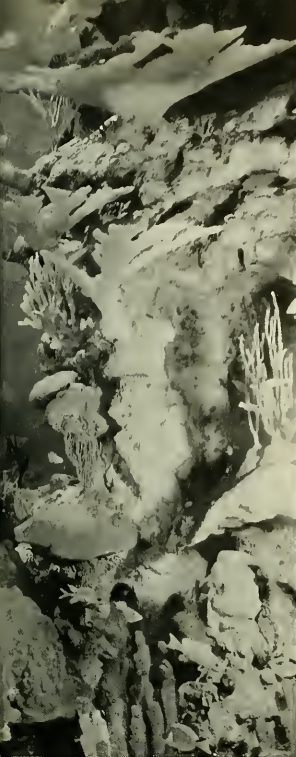


(Left) The weird trumpet fish, with its elongate, extensible snout and Zeppelin-like body, floats slowly through a school of spotted hinds



(Below) A cluster of tube-building marine worms expands purple, flower-like heads on the side of an eroded coral pedestal





A green moray lurks within an arched cavern, ready to attack any passing creature with its array of needle-sharp teeth

(Below) Around a fanlike elkhorn stit banded butterfly fish, slippery dicks, female and young blueheads. A surgeon fish swims below them

(Above) Gnarled, interlacing branches of the elkhorn coral form dense forests of stone trees rising to the water surface from the sea floor

(Below) A gray snapper (upper left) darts down among the smaller blueheads. A blue-striped grunt swims in from the right





Queen

Trigger

Fish

Its striking colors and unbelievable form startle the observer. Bright green blends into equally bright purple. Part of the face is yellow, slashed by blue lines of the utmost brilliancy. Lightning-like streaks of black and yellow radiate from the eyes

landish affair to the school of more normal looking rock hinds (*Epinephalus adscensionis*) swimming near and above it, their bodies patterned with reddish, oval spots.

The trumpet fish is headed toward a growth of sea feathers. Let us look in the same direction downward to the right and behind the beautifully symmetrical growth of elkhorn coral with the clustered sea fans at its base. Peering in here carefully, we see two huge, rainbow parrot-fishes (*Pseudoscarus guacamaia*) lurking in the shadows. Their name is quite appropriate, for they have conspicuous blue teeth, continuing the shape of the head in parrot-like profile. The scales of the hinder portion of the body are green edged with brown, while the forward part is of variable reddish brown. Let us compare them with the blue parrot-fish (*Scarus caruleus*), in the cave at the extreme right of the group. These fish are uniformly blue, though in some individuals this may shade into dark indigo.

The conspicuous teeth are white and are very powerful grinders. I have watched these creatures through the windows of my helmet, as they swam out of their cavern and nosed about the rocky surface flanking it. They would actually bite off pieces of the limestone, grind them between their powerful teeth, presumably to get at the boring worms, sponges, and other nutriment permeating the porous substratum. After the rock was ground to powder, they would eject it from their mouths, and I could see the clouds of pulverized limestone rising toward the surface.

A school of gray snappers (*Lutianus griseus*) edges out of the lower part of the cave below the blue parrots and turns to the right where blue tangs or surgeon fish (*Acanthurus cæruleus*) are circling uncertainly. These are vertically flattened fishes, rounded in outline. Their color is a chocolate-brown with fine blue lines running through it. The edge of the dorsal fin is lined with blue. Their name is derived from the sharp curved lancet on either side of the peduncle of the tail. This may be erected and will lacerate the hand to such an extent that there would be no doubt about its capacity for blood-letting.

Blue-striped grunts (*Hæmulon sciurus*)

are swimming out from the extreme lower right of the group, past posts of *Dendrogyra* coral, their flat-nosed bodies adorned with a striking pattern of narrow, alternating blue and yellow stripes. The blue lines often gleam as the fish turns in the sunlight, so as to appear almost iridescent. Above the ledge where they are swimming is an obliquely sloping shelf capped with encrusting green brain coral (*Maandra viridis*), from which a small forest of gorgonian sea bushes is growing, partly obscuring the entrance to the Cavern of the Blue Parrot-fishes. A closely packed school of spotted hinds (*Epinephalus guttatus*) swims downward past the clump, keeping in ordered phalanx as though it were perilous to direct their course past the den of the larger fish.

A MARINE KALEIDOSCOPE

Before we turn away from the group, our eyes catch a flash of color, and we stoop to examine at close range a squadron of squirrel-fishes (*Holocentrus ascensionis*) sliding past in front of the cluster of mushroom-like orb corals already mentioned. These little fishes are brilliant scarlet in color with darker stripes running the length of their body. Their huge, dark-red eyes seem out of all proportion to their size.

These are only a few of the multitudinous fishes ordinarily associated with a Bahaman coral reef. The entire number of species recorded from the Bahamas mounts up to more than a thousand. The Coral Reef Group is carefully planned to display a balanced association of reef-life, occurring at a definite locality, with the number of species likely to be noticed readily during an average trip to the sea bottom if one were observant and had time to take stock of his surroundings. It must be remembered that the scene would be changing constantly, and the observations of successive visits to the same locality would never be identical. Then, as we moved from place to place along the same reef, every location would be different from the rest. The character and arrangements of the coral growths and associated forms would change kaleidoscopically, one factor becoming dominant in a given region, while in another place it would be of secondary importance.

The Ethiopians and Their Stronghold

The people of Abyssinia and the rich and varied region they inhabit in the African highlands

*Photographs by the Author
and Alfred M. Bailey*

BY WILFRED H. OSGOOD

*Curator, Department of Zoology,
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THE country now called Ethiopia, but better known as Abyssinia, has a long, interesting history and there are many reasons why it remains independent of European control. It is situated a few degrees north of the Equator and slightly inland from the mouth of the Red Sea. The French port of Djibouti, with which its capital is connected by rail, lies directly in the path of round-the-world travel, so it is no longer inaccessible.

It has an area nearly a third larger than England, France, and Italy combined. Its uncounted population is no less than five millions and may be as many as ten. These millions, who are not Negroes but are brown-skinned people of northern derivation, have long been isolated from the modern world and are still living practically as they did hundreds or even thousands of years ago. The greater part of the country is fertile highland, wooded and watered, and it is blessed with a glorious and healthful climate. Unquestionably it is the finest piece of unappropriated real estate on the international horizon.

A few years ago, on returning from a lengthy zoological expedition to this country, I referred to it as "The Tibet of Africa." This seemed justified by its independence and isolation, its rugged highland territory, its religious peculiarities, and the prevailing tales of mystery about it. Although these comparisons still hold, conditions are changing rapidly and, as events seem to be forming, it may soon be more appropriate to take another Asiatic source of analogy and call Ethiopia "The Manchuria of Africa." In other words, the old Biblical query "Can the Ethiopian change his skin?" may need revision to "Can the Ethiopian keep his skin?"

The answer to this question perhaps should come from experts in colonial history and international relations. Any judgment, however, must take into account

the history and character of the people, the physical and climatic conditions under which they live, and the resources they have at their command. During the years in which the country was practically a closed territory, it was natural that many wild stories and misconceptions should circulate. Some of these were sufficiently sensational to be easily exaggerated and the reports of border clashes were often highly colored. It was said that the Ethiopians tortured and mutilated their prisoners, that they cut off the hands and feet of their own offenders, that they killed and scalped men as a prerequisite to marriage, that they kept slaves and cruelly mistreated them and, worst of all, that they actually fed on raw meat! Could there be any doubt, then, that they were savage barbarians unworthy of respect or consideration?

Some of the accusations against them have at least partial foundation in fact but, actually, the Ethiopians of today are a mixed people of whom the ruling class and a large percentage of the entire population are no more savages than were our own ancestors, in western Europe, during the Middle Ages. In the present world they are anachronisms, but this probably is due less to inherent qualities than to their long isolation and their devotion to a religion which is essentially the same as our own. They trace themselves back to the dawn of history and during thousands of years their original stock has been subject to infiltrations from various directions. Today, they show effects of mixture with Egyptian, Arab, Israelite, and Negro.

For centuries what is now Ethiopia was little more than a collection of jealous kingdoms and warring tribes, some of which were naturally cohesive and others quite the reverse. The present boundaries and



A plateau in the Chercher Mountains, situated in southern Abyssinia. There is an atmosphere of contentment in this region, for the soil is fertile, and crops are raised with a minimum of labor. Irrigated groves of coffee trees line the hills, and caravans laden with coffee are frequently seen on the ancient Harrar caravan trail. At the left is a contrasting scene in Addis Ababa, where automobiles go honking through the crowds and even traffic officers occasionally are to be seen



(Above) A chief of northern Abyssinia with his followers and two visiting Italian officers



(Left) A young chief with an embroidered tunic and silken undergarments. He is accompanied by priests who are always in evidence

(Below) Coptic priests gathered at an old church. There is much feasting, fasting, and pageantry in Abyssinia, and religion is taken very seriously





Haile Selassie, the ruler of Abyssinia. This photograph was taken when the present king was Ras Taffari, prince regent and heir to the throne. He is patriotic, enlightened, and progressive, and while he is hampered by tradition and prejudice, is nevertheless the real ruler of the country

(Right) Ras Hailu, the royal-blood chief of Gojam, with a priest and an escort marching from his compound to meet the expedition led by Doctor Osgood



centralization of power were achieved less than forty years ago by Menelik II who proclaimed himself Emperor in 1889 and thereupon started an unprecedented series of conquests and consolidations of kingdoms. He was enterprising and progressive, welcoming new ideas and looking forward to the modernization of his country. Most important were his negotiations leading to the building of the railroad from Djibouti to Addis Ababa. After his death in 1913 there followed the short reign of a weakling boy-emperor, Lij Yasu, who was deposed in 1916. Zauditu, a daughter of Menelik, then became Empress to rule jointly with Ras Tafari Makonnen, who was appointed Prince Regent and Heir Apparent. It is a tribute to the power and wisdom of Ras Tafari that he was able to continue with a difficult dual régime, promoting modern ideas against considerable internal opposition until he was free, in 1930, to proclaim himself Emperor in his own right under the name Haile Selassie.

THE RULER OF THE COUNTRY

During our expedition we were variously interviewed or entertained by the Prince Regent, who quite won our admiration and respect. He is educated far beyond the majority of his people, relatively young (42 at present), progressive, and earnestly devoted to the welfare of his country. He speaks French with ease and reads widely to keep in touch with world affairs. Although possessed of great dignity and obvious firmness, his manner as we observed it was gentle and good-humored, his smile undeniably sweet and sympathetic, and his mind quick and ready. He is not large physically and there is nothing of bluster and bravado about him. He impressed us as being thoughtful, discreet, and diplomatic rather than headstrong or reckless. Nevertheless, he has a record as a fighter and, like all Ethiopians, there is no doubt he is one. It is common knowledge that he keeps in condition to take active command of his troops if necessary. That he could and would do so was testified to us by some of those who had followed him to their sorrow on long, gruelling horseback rides. His enterprise and nerve have frequently been

demonstrated. For example, once when he was invited in Aden to take a short flight in the first airplane he ever saw, he immediately accepted and went up, to the amazement and consternation of his entourage.

One of the great distinctions of the Ethiopians is their adherence to a Christian religion. They are Christians of the Coptic or Monophysite branch which originated in Egypt and is supposed to have reached Ethiopia through the medium of some ship-wrecked sailors about 330 years after Christ. Practices which originated at that time are still carried out to the letter. In fact it is likely that the devout Ethiopian would regard a modern fundamentalist as a pronounced radical or, more probably, a heretic. The priesthood is very numerous and is said to comprise about one fourth of the male population. The priests do no productive labor and to that extent are parasites. There are slight signs of lessening clerical power, however, and it is even possible to find Ethiopians who are free-thinkers or agnostics. Of interest in this connection was our experience with priests and minor chiefs in outlying districts who invariably brought up the subject of whether or not the earth is flat. It furnishes an interesting bit of evidence as to the stage of thought in which the country finds itself and the difficulties with which its progressive and well-informed rulers have to contend. No wonder the country has been described as having "one foot in the Middle Ages and the other in the League of Nations." In addition to the Coptic Christians, there are hosts of Mohammedans, these having been greatly augmented when the southern provinces were brought under the domination of Menelik. Pagans in the farther provinces also are not a few. Religious differences, therefore, are among the country's present and future problems.

The Ethiopian terrain is a natural stronghold, the largest mountain area on the continent of Africa and the principal fountain head of the great Nile River. Although called a plateau, it is by no means uniform in character. Its grass-grown valleys range in size from mere pockets in the hills to great plains like those of Shoa,



(Above) The Gallas are strictly a pastoral people, who are occupied principally with their herds of cattle, sheep, and goats



(Right) The attractive courtyard of the hotel in Addis Ababa at which Doctor Osgood and the other members of his expedition stayed

(Below) Such markets as this one of Budessa are the meeting places of the natives for miles around





(Above) A strange old custom in Abyssinia results in chaining a debtor to his creditor

(Left) A good-natured bandit. Bodies of such men seem to prey principally upon each other, and a well-equipped expedition has little to fear from them

(Below) A horseman of relatively small means and position is nevertheless likely to be as proud as the governor of a province. They always ride with the big toe in the stirrup



Dejasmach Ayala is the ruler of a great part of the Simien Mountain country and the territory lying westward to the Sudan. As with all Abyssinian chiefs his power is absolute in his own territory. He makes reports and pays dues to the ruler at Addis Ababa, but the central government is remote and outlying rulers are little hindered



Music and dancing by a band of slaves. The man at the right is of the usual Ethiopian type. The musicians are pure Negroes, and, though slaves, are quite as contented as the others



where the armies of the world could maneuver. The valleys are mostly about 8000 feet in elevation and are variously bordered by rolling hills, by well-defined ranges, or by isolated mountain masses ascending to ten, twelve, and fourteen thousand feet. Here and there they are cut by deep, precipitous gorges, many of which are concealed from view until one is at the very brink of their yawning chasms. Small streams of pure water are frequent in the mountains and there are large, beautiful lakes in some of the valleys. At lower elevations, however, and especially in the south and east, there are large waterless districts to be crossed before reaching the plateau.

THE CLIMATE

The climate of Ethiopia is that delightful one always found at high altitudes near the Equator. From October to May there is practically no rain and conditions for travel and bivouac are ideal. Insect pests are so few as to be negligible and, since the dreaded tsetse fly is quite unknown, mules and horses can be used, so one travels much as he would in the western United States or Mexico. In fact, if one seeks a western analogue of Ethiopia, he finds it fairly well exemplified by Mexico. If Mexico had but one coast and if it were backed up on one side by the wilderness swamps of a great tropical river system, it would have considerable resemblance to Ethiopia.

In the wet months, June, July and August, travel in the highlands is next to impossible and any military campaign which does not take this into account is likely to find itself bogged down. At any season, the passage of the larger rivers (and the Nile is not the only one) is likely to be hazardous and only possible at particular spots. Moreover, some of the mountains are among the most dissected and precipitous in the world. This was the considered opinion of Mr. Cutting, of our party, who was fresh from ibex hunting in the Himalayas, and myself, with a varied experience in the Andes. The conditions for guerilla warfare, therefore, are excellent, at least in many large districts.

Except in and about the capital and in a

few other places, there are no roads and no wheeled vehicles of any kind. Extension of roads from Addis Ababa has begun, however, and light motor cars have been taken considerable distances in an experimental way.

The possession of horses, of course, is a mark of comparative affluence and the common multitude goes on foot. Barefooted and carefree, they think nothing of trotting or walking for incredible distances. Under necessity, any of them under forty years of age would run for twenty-four hours at a stretch and think nothing of it. "Carrying the message to Garcia," therefore, is one of the easiest things they do. At this sort of thing I would match them against any people in the world. One of our caravan men was exceptionally fleet, and as we watched him, we could not avoid expressing the wish that he might be put in training to contest the distance championship of the world. The Ethiopian is also practised in making long, solitary journeys in concealment, since this is a common necessity, even at the present day, on account of intertribal hostilities.

The resources of Ethiopia, so far utilized, are mainly those of an agricultural and pastoral people. The food supply, although not greatly varied, has always been ample for their needs. This has been so in spite of primitive methods and in spite of the large part of the population that does not work in the fields. Excluding the priests and the vassals who act as guards and hangers-on throughout the feudal society, it is evident that scarcely half the able-bodied males have any productive occupation.

STOCK RAISING

In addition to the direct products of the soil, the country has a great wealth of live-stock, cattle, sheep, goats, and poultry. The one common domestic animal they do not have is the pig, for the Copts will not eat pork and the Mohammedans will not even touch it. No one knows the number of their cattle, but it must run into millions. They are of the humped variety and probably came in from India at a very early date. The conditions for stock raising are almost ideal and it seems scarcely open to doubt

that Ethiopia might take an important place among the meat-producing countries of the world. Our expedition, which at times was divided into two sections, was able to cover nearly 2000 miles of trail and to make nearly 200 separate and distinct camps. We never had less than thirty mules and horses and, occasionally, there were as many as seventy-five. Yet natural forage and water for them was only rarely insufficient in a few districts not on the main plateau. By and large, forage was never a serious problem.

The mineral resources of Ethiopia are not very well proved at present and it is not unlikely that they have been exaggerated. Volcanic formations prevail throughout most of the better known parts of the country and reports of minerals come mainly from western provinces that are relatively inaccessible and rather loosely governed. Placer gold in limited quantities has been brought out for centuries and, no doubt, a gold-bearing area exists. Nevertheless, no development has taken place.

THE FORM OF GOVERNMENT

Ethiopia is still an old-fashioned, absolute monarchy. At least theoretically, the hereditary ruler is all powerful with all landed rights and full dominion over each and every one of his subjects. Every man is subject to his call to arms and, through a hierarchy of provincial governors, overlords, and petty chiefs, every man is subject to taxation and to other forms of service. It might be supposed that this would produce a race of subservient people, but such is not the case. It seems rather to promote loyalty, a fighting spirit, and a passionate desire to protect one's own. This is not to say that jealousies and intrigues, bitterness and suffering do not exist; but if one is brought up from childhood to follow a leader, to defend him, to fight for him and risk one's life for him, then the idea of fighting for a cause is likely to become fixed. Personal bravery is the greatest of virtues and the coward is everywhere laughed down.

Actually, the power of the sovereign is considerably modified by the provincial chiefs, some of whom have very large followings. Councils of these chiefs or gov-

ernors are being resorted to more and more, and the seeds are being sown for at least a slight semblance of representative government. There are some twenty provinces of varying importance. Although appointed by the Emperor and under tribute to him, the governors receive no salary and must perform exact their tribute and personal fortunes from their subjects. This, of course, can lead to vicious practices, but the actual necessities of life are so easily obtained that individual suffering is minimized. In Addis Ababa one sees a certain number of ill-nourished and obviously unhappy people, and it is well known that certain diseases may claim a good many, but taking the country as a whole, the people give the general impression of being well-fed, strong, and vigorous.

CHARACTERISTICS OF THE NATIVES

The men of our caravan were as miscellaneous a lot as one would find anywhere, but all were marked by a certain independence and by a disposition to demand what they regarded as their rights and thereafter to set great store by the sanctity of their contracts. Pride and suspicion were usually apparent, but a sense of fairness was highly developed. Their ideas of right and justice are based on good old Christian precepts and the simple, direct way in which they would fall back on them often took us by surprise. Having, myself, been born in New England, I was able to meet them on their own ground, at least to some extent, and the result was usually satisfactory. After eliminating a few bad characters, we had no difficulty in managing them.

Among the best of the caravan men were quite a number whose fine qualities constantly excited our admiration. They were fine physical specimens with tireless energy, industry, intelligence, and faithfulness which could scarcely be excelled anywhere — men one would choose for service among any race of people in the world. Above all, they were never physical cowards. This was proved repeatedly in encounters with dangerous animals, in hazardous undertakings against natural obstacles of mountain or river, and in meeting real or fancied



A peace-time army merely following a chief. Though many men have guns, few have any ammunition, and some may have to go from one year's end to the next without firing their weapons



A galla warrior. The Arrusi Gallas are a hardy set, and although they lead a pastoral life, they take great delight in hunting. This man proudly assured Doctor Osgood's expedition that he had killed the "anbassa" (lion) from which his hairy cape was taken. The skin, however, was that of a goat

A Dejasmatch, or general, is entitled to wear a lion skin headdress and cloak. Such men often possess great influence in the lives of many people



(Below) An untrained caravan boy at his favorite sport — pretending to be a soldier



(Below) Though Abyssinia has many hundreds of thousands of men who could take the field as soldiers, few of them are trained. These soldiers in khaki uniforms have, however, had some training, and are shown here drilling for a local chief in a northern province. Such bodies of troops are not numerous



hostilities from local inhabitants along our way. Furthermore, their loyalty to us and their willingness to risk their lives in our defense were never in question.

These are the sort of men that would make up an Ethiopian army. They have little initiative and are burdened with custom and superstition, but under direction they work willingly and efficiently. In their feudal system, as guardians and armed followers of their lords, they do no work and spend much of their time in complete indolence, lying about courtyards like so many hunting dogs. If a fight is in prospect, however, they show amazing energy. The possession of arms is pretty general throughout the country, but effective weapons are seldom available except through the provincial chiefs and the central power. The Ethiopian with a gun is usually found to have no ammunition for it and no means of obtaining any. Often he carries it proudly for years without ever firing it. The assumption that all Ethiopians are good shots and experienced riflemen, therefore, is not justified.

MILITARY TRAINING

On the other hand, the tremendous desire for proficiency with arms and the universal tradition of fighting make it certain that these men would respond quickly to training. A well-organized army does not exist. The Emperor has a small body of real soldiers well trained by experienced European officers and a few of the more important provincial chiefs have handfuls of men who have been given special discipline. Aside from these, the army would be composed of the legions of retainers who are always ready to respond to the call of their masters. They would come in large bodies, moving with no apparent order or precision, but they would not be mobs. They are accustomed to moving en masse, to carrying their subsistence, and to making and breaking large encampments. Somehow each individual would do approximately what he ought and serious confusion would be avoided. If provided with proper arms and perhaps officered by adventure-seeking drifters from the late World War, it is difficult to believe that these men could

not be built into quite an effective fighting force in a very short time. Their numbers are problematical but there is little doubt that 200,000 to 300,000 could be mustered almost at once.

In default of a modern subsistence corps, probably large numbers of women and minors would follow the army, driving herds of cattle, sheep, and goats, and the countryside would be razed. For a short campaign this might be successful, but it could not be long continued. Small marauding groups could maintain themselves indefinitely. Rifles and probably machine guns may be available to them in unsuspected numbers, but a continuing supply is another matter, for their credit resources must be very limited. Their vulnerability to airplane attack is probably overestimated, for their population is nowhere greatly concentrated and their terrain provides numerous natural places of concealment for large bodies of troops. Addis Ababa, with less than 75,000 inhabitants, is the only city of any size, and even small villages are few and widely separated. The vast majority of the people live scattered about and only congregate at intervals at market places which are deserted at other times.

It is probably not open to argument that a modern first-class power determined to do so, could subjugate Ethiopia. On the other hand, it seems equally certain that it would be a very costly undertaking and very likely a long-drawn one in which the sympathies of the world might well be with the weaker party. That the Ethiopians would resist invasion to the limit of their ability can almost be taken for granted. If there ever was a country determined to the last man to fight for its territory, it is Ethiopia. It is more than a determination and might be called a patriotic fervor. One meets it on every hand and the mere mention of possible foreign subjection is often sufficient to set off a passionate outburst of feeling that is unmistakably genuine. From childhood to old age the thought never leaves them that their country may be attacked from without. That they should do anything but fight, in this event, never even occurs to them.

José

Two months from the life of a Barro Colorado coati

BY FRANK M. CHAPMAN

Curator of Birds, American Museum

Photographs by the Author

WHEN, in December, 1934, I returned to my "Castle" on Barro Colorado in the Canal Zone, I was determined to have a feeding-place for birds that would defy the raids of coatis. All my previous attempts to circumvent these intelligent animals had failed. In December, 1931, toucans had just begun to feed from a tray hoisted by a pulley to the limbs of a cecropia when the coatis discovered it and the toucans knew it no more. Other devices were equally futile. Unfortunately all my prospective bird guests, toucans, tanagers, honey creepers, etc., were fruit-eaters, and I had nothing but bananas and papayas to offer them. Both of these fruits are favorites of the coati; of the former, indeed, he is inordinately fond and its far-reaching fragrance appeals to his marvelous sense of smell with all the force of a dinner bell to a hungry boy.

Some years ago, to prevent ripe bananas from drawing insects into the house, I placed them in a well-covered mail box nailed to the clapboards just outside my door. A few hours later, when I returned, the box was down and the bananas had disappeared. After the box had been re-nailed to its place, a coati was seen sitting on its lid. This opened upward and the coati was therefore obliged to tear it from its fastenings before he could secure what he evidently was certain it contained. In short, coatis are highly intelligent animals with a wide range of activities. To see the dirt fly before their long, curved nails and muscular legs, as they unearth some luckless grub, is to be convinced that they are preëminently terrestrial. To watch them select and pluck ripe almond nuts from the tip of a branch 150 feet in the air, you are equally certain that they are in the highest degree arboreal. But the promptness with which they seek

the ground, when they realize that they have been seen above, leaves no doubt that it is their real home. When, therefore, I decided to match my wits against those of the coatis, I felt from various experiences that the odds were in their favor. On the other hand, I believed that there must be some place accessible to wings that was beyond the reach of a quadruped weighing from fifteen to twenty pounds or more. The air, halfway between my observation balcony and the forest, seemed to offer such a place. From my balcony post Arturo and I, therefore, ran two parallel wires, the size of a pencil-lead, to the nearest forest tree, distant twenty-eight feet, and from them hung a shallow, wire-bottomed tray. A simple arrangement of strings with a pulley attached to the tree enabled me to draw the tray to and fro. Placing a banana and slice of papaya in it, we contemplated our work with satisfaction, bade birds partake and coatis observe.

JOSÉ APPEARS

The birds, it must be confessed, were long deaf to our invitation; but at least one coati accepted it promptly. All coatis are endowed with so strong a personality that involuntarily one thinks of them not as species but as individuals. Then, if a certain animal is seen often enough, it soon acquires a name, but why this particular coati was called "José," I am unable to say, although I christened him. The name seemed to fit, and, in time, he appeared to accept it.

Apparently we had placed our feeding-tray above a route along which, in his regular rounds, José passed daily. It was his nose that first informed him there was a banana in his territory. To him its odor was doubtless as impressive as a tangible substance. He stopped, twitched and wrinkled his sensitive nostrils, and with his long,



José climbs the balcony to take a banana from Doctor Chapman's hand, but he has yet to learn where the banana ends and the human fingers begin. Doctor Chapman's right foot is pressing the camera bulb

José hauls the banana upward to the tray



A supreme demonstration of balancing. Failing to reach the banana from the pole, José secures it by descending to the tray



José tackles the problem of securing a banana suspended from the tray at the end of a three-foot string



slender snout "tried the air" in circular sweeps or vertical tosses of the head. A banana might be in full view but it was his nose rather than his eyes on which he depended for information. (Later this was proved conclusively.) He went a little to the right, then to the left, climbed a stump, ran out on a reclining tree-trunk, stopping frequently to test the air, until by a series of nasal triangulations he appeared to have located the source of the smell that so strongly attracted him. Then, if possible, he went directly to it.

FOLLOWING HIS NOSE

That he could reach my tray, suspended in mid-air, I did not for a moment believe; but the situation did not seem to worry José. Having made his observations and decided on a course of action, he easily and confidently shinned up the tree to which the wires were attached until he reached their level; then he paused. The next stage toward that increasingly alluring scent was different from anything he had ever seen before; but that did not prevent him from investigating it. Nose swaying and tossing, he pushed his forefeet carefully out on one of the wires and, balancing himself with his tail on the other wire, he covered about half the distance to the tray and the banana, when he suddenly lost his nerve and, almost falling, scrambled back to the tree.

At once he began a second trial. This time he reached the tray, grabbed the banana, and started to return with it so quickly that he lost his balance, but clung to the wire upside down and regained the tree, hand over hand. But he did not lose his head or sight of his objective. Sliding down the tree backward, he went straight to the banana, which had fallen from the tray, and devoured it on the spot. It was certainly small enough reward for the effort expended.

José soon became an astonishingly skillful wire-walker. The distance of the tray from the tree was gradually increased until it was halfway to my balcony. But if the trays held a banana, José started on his seemingly impossible journey without hesitation. One might have expected a small monkey to be at home here, but that a heavy,

plantigrade animal could so quickly learn to progress on a wire so small that it looked as if it would break beneath his weight was amazing. It was, however, an obviously difficult undertaking calling for courage and skill. His body quivered rigidly with the intense muscular effort required to maintain his balance.

Only once in his many journeys to the tray did he fall. Then it turned over with him, and he seemed to dive nose first the eighteen or twenty feet to the ground. But the banana accompanied him and, on landing, without a moment's loss of time, he continued his meal.

Although José had now learned to associate the bird-tray with bananas, he continued for some days to be guided by his nose. Each time, before mounting, he assured himself by scent that there was something there worth the effort. It was not until later, and then rarely, that he climbed to the tray when it was without a banana.

JOSÉ'S ADAPTABILITY

Four days after the initial venture on December 13, I varied the proceedings by suspending a banana from the tray at the end of a three-foot string; but this procedure occasioned José no difficulty whatever. He merely continued to follow his nose. Looking over the side of the tray his eyes confirmed what his nose had already told him. The fact that the object of his desires was beyond his reach was readily remedied. With a skill gained perhaps through long experience in pulling almendro nuts on terminal branches, he hauled the banana up hand over hand, with occasional assistance from his teeth, and devoured it in the tray at ease. In fact, he became so at home in the tray that, his banana finished, he often remained there to yawn, scratch, and rest.

Further to test José's adaptability I now hung a banana from the end of a stick projecting from the hillside below my balcony at an angle of about 45 degrees. The first question to answer here was the location of the fruit. As before, this was done through the sense of smell. Then the best method of approach was considered. Seen from below it seemed to be near the tray which at the

moment chanced to be over it, and it required a journey to that swinging platform to convince José that he was on the wrong track. Eventually he discovered that by going up the hill, apparently away from the banana, he could reach the base of the pole from the tip of which it swung. Then followed a journey of nine feet on the pole to reach the string. This trip occasioned José more difficulty than the one over the wires to the tray, and demonstrated the importance of his tail when climbing. There were two wires, and the one that supported his tail was as useful as the one that supported his body. But the single pole offered small support to the tail as a balancing organ, and José was upset several times before he reached the string and pulled up the banana. But he always held on to it, even when upside down, and, pulling and biting, accomplished his end. Then, victorious, he returned to the ground. On one of these trials the pole broke, depositing José ten feet or more down the hill. But he seemed as resilient as rubber. The banana fell with him and was at once retrieved. I regret that I cannot show José the motion picture I have of this incident.

INTELLIGENCE TESTS

In the next test of José's intelligence, a string was thrown over a single wire about ten feet from the ground. A banana, tied to the free end, hung about three feet below the wire and hence seven feet above the ground. The other end of the string was made fast to the ground directly under the banana.

This puzzle José solved almost at a glance. Approaching upright, on his hind legs, he was soon convinced that he could not reach the banana, so he clasped the grounded string in his forepaws and, sailor-like, pulled it down. When the banana refused to cross the wire he pulled harder and, as a last resort, furiously bit the string until it was severed and the banana fell at his feet.

The ground, or longer end of the string, was now moved to the end of the nine-foot pole, previously mentioned, where its relation to the banana hanging over the wire was less obvious than when it was directly

below it. But it was sufficiently clear to José, and although the hauling and biting were done less easily from the unstable footing at the end of the pole, they were never shirked, and sooner or later the prize was won.

PERSISTENCE

Persistence, indeed, was José's dominant characteristic. He might rest between attempts, but in no single instance did he fail to win his reward. After a fruitless effort he would retire to a favorite resting place on a partly fallen trunk, stretch out with chin on paws, at intervals yawn widely and otherwise give evidence of the fact that he had no interest in bananas. But ever and again their tantalizing fragrance reached his nostrils, his head went up, he whiffed the air on this side and that, and finally, unable to resist, returned to another and, eventually, successful attempt.

Without a diagram it is difficult to give a clear conception of José's actions. Whether intentional or not I do not pretend to say, but he often apparently followed plans which seemed at first to lead him far from the end in view. Thus, when I hung a banana from a single wire, he seemed to realize at once that it was beyond his reach and made no attempt to climb to it. But that does not mean that he gave up the banana. Climbing up the tree to which one end of the wire was fastened, he pulled the wire so violently that the banana was shaken from it. Whether José anticipated this result or just pulled on general principles is unknown, but the moment the banana fell, he hastily descended the tree and went to it.

This maneuver was repeated with variations. In one instance the banana was hung from the tray on its trolley midway between my balcony and the forest, where it apparently could be reached from the end of the pole already mentioned. The pole was first tried, and although José gave a supreme demonstration of his balancing powers by rising to an upright position at its end, he lacked the nerve to make the needed spring for the fruit. Whereupon he returned to the ground, went fifteen feet to the base of the "tray tree," climbed



1.

*The suspended
banana proved to
be beyond José's
reach*

2.

*So he climbs out-
ward on the pole
from which it is
suspended*



4.

*Then devours it at
his leisure*



3.

*Seizes the string
and pulls it up*



twenty feet up to the attachment of the trolley, slid fifteen feet out on the wires to the tray, pulled up the banana, and ate it where he sat. After seeing such an exhibition of intelligence, one understands why *Nasua narica panamensis* is a successful species.

A FUTILE DEFENSE

Another case in point occurred late in our relations. Finding that a tray suspended in mid-air was as accessible to coatis as it was to a pair of beautiful "Sangre del Toro" tanagers that had begun to visit it, I decided that the birds' rights must be defended. Arturo, therefore, placed on the "tray tree" below the trolley wires, a large umbrella-cone of sheet zinc. In vain the other coatis tried to surmount this guard. Around and around they climbed beneath its overshadowing roof, no opening could be found. In vain they tried to climb over it; and shortly, they abandoned further attempts. But, so far as I know, José never tried to pass this obstacle. His familiarity with the surroundings taught him a better way. Going thirty feet farther into the forest he climbed another tree to a point where its branches touched those of the tray tree, crossed to it, and slid down it to the point above the guard where the trolley was attached and, as before, slid out on the wires to the tray and the tanagers' banana.

To learn more clearly the respective parts played by José's eyes and nose in the location of food, I carved and colored a wooden banana with such unexpected success that a banana grower to whom I showed it told me the variety to which it belonged! When this was exposed alone, it attracted no attention; but when there were real bananas near it to supply the characteristic banana fragrance, its appearance was sufficiently deceptive to call for some inspection. At the most a mere touch, and more often a sniff at a distance of six to eight inches, was sufficient to reveal the fraud. Another experiment supplied more convincing proof that José's chief provider is his nose.

After he had become wholly accustomed to securing a banana tied to the end of a string hung from what was designed to be the tanagers' tray, the suspended banana

was placed in a box. It was thereby concealed from his eyes but not from his nose, and the boxed banana was retrieved just as readily as though it had been fully exposed. When, however, the box was hung without a banana, the absence of the fruit was usually discovered by sniffing from the ground and no closer inspection was made. But if a banana was placed in the tray and an object about a banana's weight, in the box, the tray banana was eaten and the box hauled up to within six or eight inches and then quickly dropped. This test was made repeatedly and no one seeing it could doubt José's complete confidence in the information he received from his nose.

It was to be expected that news of José's good fortune should spread through the neighboring forest. It may have been banana borne, it may have been communicated by the coatis themselves. The fact remains that I had visits from other coatis than José.

During the greater part of the year male coatis live alone, while the female is accompanied by her five or six young, probably until, in the summer, another family appears. Several times I was visited by a female and her well-grown children; a harum-scarum lot scampering through the edge of the forest and coming out cautiously for bananas; for they had small faith in me. If José was present on such occasions he paid no attention to these strangers. Perhaps he would not have recognized them if they had been his own offspring.

Several times a second male appeared. Just what his relations were with José I do not know, for the two were never present together. José was slightly the larger and I think the older of the two and was further distinguished by a golden suffusion resulting from a dash of dilute picric acid I poured upon his back. This enabled me to identify him, not only at home but should I chance to meet him abroad.

It might be imagined that an unfailing supply of bananas would induce José to make the vicinity of my balcony his permanent abode. In truth he visited me but twice daily, in the morning and again in the afternoon. The length of his stay was not



A nasal reconnaissance

*José takes
a short nap*

*Other coatis than
José come to visit*



dependent on the available supply of bananas. I was often prepared to give him as many as he could dispose of, but six seemed to be his limit. This, however, was late in the morning, and who could tell what genial assortment of nuts, grasshoppers, grubs, and lizards had preceded them? His wants supplied, José was ready for a short nap in one of several favorite resting places in the fallen tree I have already mentioned, but for a real siesta he disappeared for several hours within a maze of vegetation enveloping a large tree just within the forest.

In spite of sundry falls, empty boxes, and a wooden banana, José did not lose faith in me as the ultimate source of a delectable food, while José's patience, perseverance, and ingenuity aroused in me a desire for a closer acquaintance with an animal of such unquestionable intelligence. By this time José had in a large measure lost fear of me and learned to look to my hand rather than to the tray or the end of a string for his favorite food. This advance in our relations was not made in a single step. It was some time before, with hesitation, he climbed the balcony, and snatched a banana from my hand in a manner that paid small regard to my fingers, and fled with it to the forest.

But the expected danger never materialized. Always there was another banana awaiting him. Perhaps, after all, it was not necessary to be so hurried. So, step by step, always forward, new associations were formed and the banana eaten calmly while I held it; an act, by the way, calling for a mutual exhibition of good faith.

That I reached José's stomach no one can doubt; that I passed beyond it to his heart is perhaps too much to expect of a creature whose heart, so far as man is concerned, had heretofore performed only a physiological function. Be that as it may, the time came when the call of his kind was stronger than any I could exert, and José disappeared. Doubtless he had abandoned the solitary ways that probably have won for him the name of *gato solo*, and gone to seek a mate in the forest.

Day after day passed and the fully ripe, strongly scented banana that each morning I placed on my balcony railing was uncalled for. But I do not give up hope that in his own time José will return to me—and more bananas. And what a story he will have to tell! What a contribution he may make to the study of sexual selection. I want particularly to know if his rich, golden, péric acid coat did not distinguish him among his rivals.

POSTSCRIPT

February 11, 1935. After an absence of two weeks José returned today. He was on the tanagers' tray when first I saw him, and after he had finished the banana he was eating, returned on the trolley to the tree at the edge of the forest. Thence he made no attempt to reach the ground over the zinc guard but climbed twelve feet up the tree to a swinging vine. This he descended, sailorwise, to a partly fallen trunk over which, by a devious route, he reached the earth. He was now well down the hill in the forest, but in response to my call, with some hesitation, for during his absence the world had not been kind to José, he came to the balcony and took a banana from my hand.

It was not necessary to ask José for his story. As he approached, it was told graphically and gruesomely by his wounds. No longer will the stains of péric acid be needed to identify him. He will be forever marked by his scars. His left shoulder is widely gashed, he will doubtless lose the sight of one eye, his left upper lip is torn and hanging, revealing all the teeth it formerly covered, and he bears minor injuries from the end of his nose to the tip of his tail. Surely he is a "bonnie fighter." What, I thought, is the condition of his enemies? But my sympathies are with José. Doubtless aided only by nature and his rugged strength he will recover. Nevertheless, I long for some means of winning his confidence and treating his wounds. At least I can give him an unfailing supply of bananas—and there will be no strings attached to them.

In Quest of the Giant Panda

An account describing the work of the Sage West China Expedition in the highlands of Szechwan Province, near the borders of Tibet

BY DEAN SAGE, JR.

DAYBREAK of September twenty-fifth found Bill Sheldon and myself climbing the precipitous slopes of the Chen Lliang Shan in search of bharal — *pan-yang* the natives call this aberrant member of the sheep family. Below us, on a tiny ledge of the mountain-side, 10,000 feet above sea level, our camp seemed to hang in an infinity of space. Above us towered the mighty peaks of the Chinese-Tibetan borderland, rearing their craggy summits 20,000 feet into heavens that glowed softly with the first rays of sunrise.

Three days of hard climbing through rain and fog had been required to reach this camp from the little hamlet of Tsao Po in the foothills, and before that, a whole week of foot travel from the city of Cheng-tu down on the plain. Cheng-tu had been our jumping-off place. One of China's famous walled cities, the capital of Szechwan Province, Cheng-tu lies on a fertile plain almost two thousand miles inland from the sea; two thousand miles of slow but interesting travel. The initial, and longest, stage is the fifteen hundred mile boat trip up the Yangtze River from Shanghai to Chung-king. Day after day, the vast panorama of the Yangtze valley unfolds itself as the little steamer chugs steadily against the broad, heavy current of the yellow waters. Endless fields of corn and rice, dotted with occasional farmhouses or small villages, stretch away to low ranges of distant hills. Ponderous junks sail placidly downstream with the current or are towed upstream against it by coolies straining along a towpath on the river bank.

At Ichang, a thousand miles west of Shanghai, the river narrows abruptly, and for the next hundred and fifty miles boils a tortuous course through a deep, cañon-like

channel, which it has cut in a rugged, mountainous country. Sparsely covered slopes, and sometimes sheer rock walls, rise abruptly on either side. The occasional, inevitable farmhouses cling precariously to these same slopes — one wonders how — surrounded by patches of corn and beans. Wherever there is a plot of earth, it is sure to be cultivated, and one is forever being surprised by some isolated patch of corn growing on top of a cliff about which a goat would think twice before climbing.

Two weeks after the date of our departure from Shanghai we reached Chung-king, a great, noisy, colorful Chinese city perched on bluffs at the junction of the Kialing River with the Yangtze. In the bedlam of sights, sounds, and smells which comprises Chung-king, we had our first initiation into the actual heart of Chinese life far removed from the big coastal ports.

Passports and permits were procured from the military officials in Chung-king, and motor transport chartered to carry ourselves and our equipment overland to our next objective, Cheng-tu. This journey we accomplished in two days' travel over a wretched bit of road, and by the afternoon of September seventh we had reached the hospitable compound of the China Inland Mission, hard by the walls of Szechwan's capital.

The long months of planning, preparing, and traveling were nearly at an end, for on a clear day we could see the snow-capped Titans of the borderland remotely beckoning from the western horizon. Our eagerness to be in the field and at work knew no bounds. Donald Carter, Bill Sheldon, my wife, and myself, whom the American Museum of Natural History had euphemistically christened "The Sage West China Expedition," felt that our goal was at hand and that we would soon be collecting birds and animals in the wild and inac-



(Above) The castle of a prince of the Ch'iang tribe, at the village of Tsao Po



(Left) A bridge across the Min River. The cables are made of bamboo fibers





(Above) The members of the Sage Expedition, with their coolies, pause for a rest on the summit of a pass in the giant panda country

(Right) The Chinn Inland Mission, just outside the city walls of Cheng-tu



(Below) A Chinese junk in the rapids of the Upper Yangtze River



cessible region whose lure had brought us halfway round the world.

Our porters preceded us out of Cheng-tu on the morning of September tenth, an impressive line of heavily burdened coolies that became consistently less impressive and consistently more irritating as we struggled with the trials of the march across the plain, through the foothills, and then into the fastnesses of the mountains themselves. And what mountains they were! Rising rugged, in serried masses, from deep-cut, narrow valleys, they seemed fairly to hurl their jagged peaks against the sky.

THE ASCENT TO CAMP

From the outset we were hampered by the weather. Day succeeded day of fog and rain, and as the autumn passed and the weather grew colder, occasional snow flurries would come swirling out of the north, driven by winds that howled wintrily through the crags, and chilled us to the bone.

The ascent from Tsao Po to our camp in the blue sheep grasslands was fairly typical of what we encountered. I quote from my diary:

"Even when we started, the clouds were fairly low, and it was impossible to see the mountain peaks, but from the general contour of the land, we seemed to be working up to a pass across the ridge which lay in front of us. The trail led directly upwards, about as steep as it was possible for a man to climb. Bill and I pushed ahead with the hunters, while Anne and Don brought up the rear to keep the stragglers going. We had about fifty men with us, and it was natural that some of them should be slow.

"We had climbed for less than an hour, when we passed into dense, wet clouds, and from that time to this, we have not been out of them. After a long pull through a bamboo jungle we emerged on to a little, open shelf and stopped for lunch. It was about twelve-thirty. From there we climbed up a steep and very sharp hog-back ridge covered with rhododendrons and spruce. The clouds were so thick that we could see only a short distance ahead, but the

ridge was so narrow that you could look off on both sides at once into a blank sea of mist. What lay below us, we could not tell. All that was apparent was that we were climbing up a mountain which seemed to have no top. Whenever we reached a level spot, we congratulated ourselves that at last we were on the summit, but always another rise would come looming dimly at us out of the fog. It was most weird, this forever climbing into the clouds with no idea where we were going or when we would get there. We had been told by the natives that there was a root picker's hut on the other side of the mountain in the grasslands. This hut was known to the Tsao Po men as the *Bei Mu P'oung-tze* (literally 'white root hut'), and was our immediate destination. We knew we should find water and wood there and a good camp site. Questions put to the men, however, elicited but little helpful information, for they could not agree either how far it was to the hut or how long it would take us to get there. Two wretchedly uncomfortable nights we were forced to spend on the mountain-side, cold and wet, and with but little in the prospects to cheer us.

"The morning of the third day we came out of the rhododendrons on to grass and rock slopes. The climbing we had hitherto done was nothing to what now confronted us, for the trail led up over ledges and crags whose abruptness was fairly staggering. The altitude was about 10,000 feet, and it was very cold. Up and up we struggled, inching a laborious way over slides and ledges and around precipitous slopes, with often a sheer drop from the narrow trail into the abyss of clouds below. Occasionally great rock buttresses and pinnacles loomed shadowy out of the fog, and ever we climbed.

"Signs of game began to appear, sheep tracks, and the droppings of badger and pheasant. I carried my rifle ready on the chance of surprising something in the gray dimness through which we traveled. It was about one o'clock when we reached the summit of the pass, 11,600 feet. The ground suddenly flattened out and gave way to a series of gently rolling inclines and grassy hollows. The fresh track of a leopard

(Right) The precipitous mountains over which the Sage West China Expedition hunted for blue sheep on the Chinese-Tibetan borderland



(Below) A native farm on a mountain-side in the province of Szechuan, between the walled city of Cheng-tu and the borders of Tibet



(Left) The members of the Sage West China Expedition of the American Museum meet a collector operating in the same region for the Field Museum of Chicago. From left to right: Dean Sage, Jr., Anne Tilney Sage, William Sheldon, Floyd Smith, the Field Museum collector, and T. Donald Carter



(Above) A photograph taken at an altitude of 13,000 feet in the blue sheep country, looking out over a sea of fog

(Left) A native with a bharal (wild sheep) collected by the Sage Expedition

(Below) Mrs. Sage and T. Donald Carter preparing the skins of small mammals in camp





(Above) William Sheldon crossing the Min River on a bamboo raft that slides along a tightly stretched cable

(Right) A waterfall in the valley through which the Sage Expedition passed on the way to Cheng Wai

(Below) Camp in the grasslands of the Chen Uliang Shan in the blue sheep country. The low-roofed building is the "Bei Mu Pong-tze" mentioned in the article



crossed the path, and game signs of all kinds became more abundant. We surprised four impeyan pheasants that flew off with loud whistles. On the ground were patches of lovely blue gentians. It was perishingly cold.

"Soon the contours began to fall away, and presently we were descending as rapidly as we had ascended. Down through the clouds we slid and groped our way, unable to see fifty feet ahead. Suddenly, without any warning, a tiny knoll appeared in front of us, and low-lying, built into its base was our long sought *Bei Mu Pong-tze*, a flat stick and mud shack with slabs of stone for a roof. Some coolies had arrived ahead of us and built a fire, and the inside of that dirty hovel was just like Paradise."

BLUE SHEEP

The end of September and the first two weeks of October we spent on the Chen Lliang Shan. We shot four blue sheep almost at the outset, and thereafter spent many long and disappointing days trying for others. Always the fog defeated us, for although we estimated that at various times we had seen in all upward of a hundred sheep, the gray pall which would occasionally lift tantalizingly to give us a glimpse of these beautiful animals, never failed to close somberly down and render stalking impossible. Often we spent hours within earshot of ledges where the tinkle of dislodged rocks told us that sheep were feeding or resting. And ever we prayed in vain for a break in the clouds.

But our fortune did not depend entirely on sheep by any means, for we had run out trap lines, and our collection of small mammals was growing steadily. Birds we also began to get, mainly pheasants caught by the natives in snares and brought in to us.

On October fourteenth we left the *Bei Mu Pong-tze*, satisfied that we had pretty well exhausted—in so far as time and weather would permit—the possibilities of the sheep lands. There was other and more exciting game to whet our appetites, namely the giant panda. This rare and little known animal inhabits the dense bamboo jungles. In general, he is bearlike in size and appearance, except for his color, which is

white with black markings. To the best of our knowledge, only two giant pandas had ever been shot by white men. The spectacular appearance of this creature, his scarcity, and the extreme difficulty of hunting him on the rugged and treacherous bamboo-covered slopes; all these factors made him a prize for which we aspired with the keenest enthusiasm.

Making our way northwestward, farther into the recesses of the great mountain ranges, we came to the beautiful valleys of Cheng Wai and the Mao Mo Gou. Here we had our first definite reports of the presence of giant panda. In a native farmhouse at Cheng Wai there were two panda skins. The farmer told us that *beishung* (literally "white bear") sometimes came into the valley. How often, he could not say. Generally, it was a single animal, though occasionally, two were seen together. Both of the animals, whose skins this man possessed, had been killed in spear traps, which we found to be the usual native method of hunting them. Infrequently, the animals' propensity for tree climbing led to one's being seen in a spot where it was possible to shoot him, even with the unreliable muzzle-loading guns which are the natives' only firearms.

And so began our quest of the giant panda. Day after day we climbed the bamboo ridges of Cheng Wai and Mao Mo Gou, in the first flush of our optimism confident of success, and as time went on less confident but ever hopeful. From the very beginning we found panda signs—chewed ends of bamboo and droppings. Some were very old; others quite fresh. We learned a good deal about the animals and their habits from our own observations and from what the natives told us. We concluded they were mainly nocturnal in their movements, wandering and feeding along ridgesides from one bamboo thicket to another, and when day came, lying up to sleep in a den amongst the ledges or in a warm spot in the sun. As to breeding habits, the natives told us that pandas mated in April and bore one cub the following January. For the accuracy of this information it is, of course, impossible to vouch.

Time passed. October disappeared into

The small, cross-hatched circle marks the region visited by the Sage West China Expedition in its search for blue sheep, panda, and other specimens



November and November into December. Our collection grew steadily as shotguns and traps brought in birds and small mammals, and skins of large animals began to come in one by one — black bear, wild boar, deer, goral, serow, takin. Most of these we bought from native hunters who, as the news of our activities spread around, would bring all kinds of skins for sale. In this fashion we even acquired a panda skin, but our own efforts at hunting the elusive beasts went unrewarded. It was hard work climbing the mountains, thrashing through bamboo jungles of unbelievable density, and as winter came on us, wading through snow and creeping over ice-covered ledges. We set spear traps; we searched acres and acres of bamboo-covered slopes with our field glasses, looking for a telltale white spot. We hunted with dogs. Unreliable curs that would run anything from a deer to a pheasant, they were a sore trial to patience.

And then one unforgettable day in December the gods relented, and the valley of Cheng Wai gave up its most coveted trophy.

Saturday, Dec. 8th, 1934

"We left Cheng Wai at 8:30 this morning — Bill and I — with quite a procession; Wong, Kan and his dog, and two other natives with their dogs. We had decided to have one last, good, long panda hunt with all the dogs we could muster. I should explain that Anne and Don could not take part in this hunt; the latter because he had gone to Tsao Po, and the former because her game knee was not up to it.

"An hour's walk brought us to some old tracks, and we turned up the ridge following Kan's route of yesterday. We climbed steadily upwards for an hour and a half, encountering the habitual cliffs and bamboos. There is no such thing as horizontal hunting in Wassu; it is all vertical! Takin sign was everywhere plentiful — more of it both new and old than we have seen anywhere else on the whole trip. We crossed one old panda track in the snow. At 11 o'clock we came to some open ledges and sat down for a bite to eat and a look with the glasses. The dogs were very restless and kept whining and testing the wind. We thought they might have detected the presence of takin, one or two of which — to judge from the tracks — had passed here yesterday.

"Ascending from the ledges, we began to swing in a general northeasterly direction along the ridge, Kan leading the way. We soon found the two- or three-day-old trail of a beishung and began to follow it. The going was very difficult, being principally through patches of bamboo and over ledges.

"We worked along the ridge for about two hours and then stopped to rest a while on a sunny slope. At this point, the pursuit seemed vain and decidedly discouraging. The track was unquestionably old; I was inclined to think three or four days, and the dogs showed not the slightest interest. They were still leashed. Curiously enough, as we were sitting there in the sun, we reviewed the shooting of both Schaffer's and the Roosevelts' beishungs and discussed the factors contributing to their success. We both agreed that almost a given set of con-



A snow-covered slope in the valley of Mao Mo Gou, where the Sage Expedition hunted giant panda

A view of the most remote mountain range reached by the Sage West China Expedition. This huge peak reaches an altitude of about 20,000 feet, and has never before been visited by white men





(Above) A typical view in the giant panda country. The picture shows a vista of the valley of Yen Hsui Gou



(Left) A group of native hunters with the giant panda brought down by Dean Sage, Jr. and William G. Sheldon

T. Donald Carter with the skin of a giant panda collected by the Sage West China Expedition



ditions was necessary to the bagging of one of these animals, and that the conditions practically never coincided with the opportunity. In view of what subsequently transpired, this conversation seemed uncannily prophetic.

"We went on for half an hour more and reached a gully where the snow was quite deep and the track looked depressingly old. I was convinced there was not a chance in a thousand. The hour was getting on, and there was not much time left to hunt. We decided as a last measure to let the dogs go and range about for a while. They started along the tracks without much enthusiasm, and we followed. I remember distinctly feeling it was a pretty hopeless chance, and I think the men felt so, too, for they kept muttering '*Beishung mutté, beishung mutté!*' I stopped to examine some old sign, and Bill and the other hunters got pretty well ahead of Wong and myself, so that they were out of sight. Hurrying to catch up with them, we came out of the snow and climbed a very steep little slope covered with dead leaves. I recall it well, for I used the butt of my rifle as a staff to help me up, and when we topped the ledge looking into a snow-filled bamboo ravine on the other side, I was breathing hard. There was a big spruce tree there, and I leaned my rifle up against it and took off my gloves. I was quite discouraged with the progress of the hunt and was turning over in my mind other possibilities as I stood there. I saw Bill moving about fifty yards above me and called out to him, 'Oh! Bill, what do you see?' He replied, 'Nothing, but the men have gone up this way; they're following the dogs.' I said, 'I think this is a fruitless procedure.' Just then came the sound of a faint and distant bark. Bill said, 'There go the dogs now,' and I called back, 'Yes, but they're way down below us.' It was true, for the sound came up the ravine on the edge of which we stood. All of a sudden I heard the unmistakable noise of breaking bamboos, and the barking became louder. Wong said, 'Beishung!'

"Even at this moment, it did not occur to me that we should ever see the animal. If indeed the dogs had started one out, the chances were he would go crashing off into the bamboos and that would be the end of it. Nevertheless, I took my gun and tried to put a cartridge in the chamber. It was all covered with snow and ice from the recent hard going, and the shell would not go in, so I threw it away, — an act which was later to become of the utmost importance — and put in another one. Above me, Bill began to climb to gain a better vantage point, but I was in an ideal spot and did not move. Up the ravine came the dogs, their barking growing steadily louder, and the bamboos crackling at a great rate. Suddenly, I heard the deep, angry growl of a large animal, and I began to get really excited. And then — as if in a dream — I saw a giant panda coming through the bamboos about sixty yards away from me. He was heading straight up the ravine with the dogs at his heels. I fired but missed. The panda made a right angle turn and came straight for the ledge I was standing on. I fired again.

He came right on, not running — walking rapidly is the only way to describe it. His head hung low and swayed from side to side. His tongue was out, and he was panting. He appeared to be looking at the ground and apparently did not see me at all. I frantically worked the bolt of my rifle and snapped the hammer on an empty chamber. In a daze, thoughts flashed through my mind: 'No more bullets; what'll I do? He's only twenty feet away, now fifteen, he's coming straight at me. Can I kill him with the butt of the rifle?' I felt a cartridge thrust into my hand. Wong had seen my predicament and picked up the one I had discarded. I jammed it in the gun and fired into the beishung's fur. He was less than ten feet from me! At the same moment Bill shot from above, and the animal, struck simultaneously by both our bullets, rolled over and over down the slope and came to stop against a tree fifty yards below.

"We had killed a giant panda."

Streamlining — Old and New

A principle long practiced by Nature, which man has begun to study seriously only since the invention of the airplane

BY HAROLD WARD

STREAMLINING may still be news to the Man in the Street, who gazes wonderingly at every motor car with a trick body — but it is an old, old story to Nature. Regularly once a year the Automobile Show presents us with “positively the last word in streamlining”; and regularly, a twelvemonth later, we are suavely informed, by demonstrations and learned sales talks, that last year’s model leaves much — in fact, almost everything — to be desired in this respect. Daniel C. Sayre, one of America’s most capable aeronautical engineers, has exposed the current streamline delusion in words to which every honest technician and designer will fervently cry, “Amen!” He says:

When they [the engineers] are told . . . that this year’s automobiles, for example, have greatly reduced their air-resistance by adding false grills to their radiators, and terrible-looking excrescences to their lower rear ends, and by rounding off a few corners — they laugh long and ribaldly. *Making a 5 per cent change in last year’s car and labelling the result streamlined, they will tell you, is like chromium-plating the knobs on your grandmother’s brass bed and hailing it Modernist* [Emphasis in original].

If one wanted to combine poetry with a very sober truth, one could add that the very tears — of hilarity or grief — with which the aerodynamic expert views the latest developments in streamlining (at least in the bulk of commercial products) themselves exhibit Nature’s way of accomplishing this result. For the “teardrop” illustrates, in transient miniature, all the essential structural features of an object designed to move through a homogeneous medium (water or air) with the minimum of resistance. Although it has not yet been established with finality that raindrops falling through the air for great distances assume the mathematically correct ellipsoidal form, it is quite certain that they do *not* fall as misshapen oblongs, with their narrow ends in front and bulbous swellings at the rear.

This is certain because of the fundamental laws of dynamics — which is defined as “the Science of Motion as produced by Force.” The two laws, or principles, which are most relevant to the whole field of streamlining — whether *aëro-* or hydrodynamics, or whether the “engineer” be Nature or Man — are as follows: (1) The resistance exerted upon a body by the medium through which it is moving is proportional to the square of the velocity, provided this be of ordinary magnitude; and, (2) The resistance of the medium depends upon the shape and size of the body, being determined *not only by the front surface but also by the rear surface*.

Read again, and carefully, these principles — especially the italicized words of No. 2. For the crux of the matter is in them. The resistance, or “drag” offered by a homogeneous medium is determined by the *velocity* with which an object is moving through it: note that I do *not* say “speed,” which is a time-rate of motion in any *one* direction, while velocity implies a change of direction. If the object is to *double* its velocity, it must be prepared to overcome *four times* as much resistance, and so on up to certain limiting values of increase. That is the first point. Now, apart from the quantity of energy applied, and the size of the body, the overcoming of resistance in the medium will depend upon the *shape* of the body, and this shape must have certain characteristics which are determined by the behavior of the medium. That is the second point, the essential problem of aerodynamics: to find for a moving body just that *shape* which will permit the greatest acceleration in velocity with the least increase in resistance and the minimum expenditure of power.

To illustrate these abstruse theoretical considerations let us take a homely ex-



Aeronautical Chamber of Commerce of America

*Unquestionably,
Nature's most
perfect example of
streamlining is
not to be found
among birds,
though the ducks
shown at the right
are streamlined
to a degree*



*The careful study of
the shape of birds
has played a large
part in the refine-
ment of airplane de-
sign. The gull at the
left shows plainly
how Nature, in one
case, has efficiently
solved the problem of
flight*



At the left is shown a transport plane capable of carrying a pilot and eight passengers. In this model the landing wheels are mounted in streamlined housings. In others the wheels are sometimes arranged so as to fold up

A sooty albatross is shown at the right. In this bird, Nature has narrowed and elongated the wings to an exceptional degree



Photo by Robert Cushman Murphy

The albatross below is shown in a position that beautifully illustrates the shape of this natural airplane



Photo by Robert Cushman Murphy

ample, which anyone may put to a test:

A flat, oblong plate — of wood or metal, with sharp edges and smooth surface — is submerged in a tub of water. Holding the face of this plate at right angles to the direction of motion, move it at a certain speed through the water. You will at once notice the “drag” which the water puts upon it, the resistance offered to its motion, and to any increase in its speed. Now, let us call this resistance at speed A 1, or unity. Next, take a squared block of the same material, its length equal to that of the plate and each of its sides equal in width to that of the plate. Submerge it in the water in such a way that one of its edges is set head-on against the direction of motion. Now move it at speed A : the resistance, despite an increase in bulk, is noticeably less; to be exact, it is only 0.82. Lastly, take a cylinder of the same length and cross section as the square block (that is, as long as the plate, and a diameter equal to its width), and move it through the surrounding water with its long axis at right angles to the direction of motion. *The resistance at speed A drops to 0.185.*

If you had conducted these simple experiments near the surface of the water, and were observant, you probably noticed that at each successive step there was a peculiar change in the character of the eddies — or “turbulence” as the physicist calls it — in the immediate neighborhood of the moving bodies. And each change was of a kind that permitted the same amount of energy to accomplish more work (cover a greater distance) in the same time. In blunt engineering terms, there was an increase in “efficiency” — all obtained by the simple trick of altering the shape of the body so as to minimize the chief factor in all resistance, whether of wind or water: turbulence.

THE LINE OF LEAST RESISTANCE

This trick, which man did not begin seriously either to understand or to utilize until Curtiss and Orville Wright made their historic flight at Kitty Hawk thirty-two years ago, has been one of Nature’s favorites ever since fish began to swim in the oceans — even æons before that, when water dripped from stalactites “in caverns measureless to

man.” “Streamlining” — aeronautical engineers call it “fairing” — is the principal reason for the swift movement of fish through the water, and adds an important factor in the swifter flight of birds through the air. And, in every instance, the resulting shape takes the line of least resistance in overcoming the counter-resistance of the medium. It does so, moreover, not because of any mystical “purposiveness” or other teleological concepts which man imputes to Nature, but solely because — as a great biologist, D’Arcy Wentworth Thompson, has elaborately shown in his classic monograph, “Growth and Form” — physical laws underlie, and determine, all observable phenomena in the universe. The marvelous structure of the tuna, which includes fins that can be drawn smoothly against and partly into its body to gain speed, is no more and no less “intelligent” than the web of a spider or the hexagonal cells of a honeycomb — both of which owe their shapes to the operation of geometric principles which flow automatically from the nature of the structural problem involved.

OBEDIENCE TO PHYSICAL LAWS

On the human plane, however, it is not possible for nature to take its course. The primitive “tree-sledge” of our ancestors could be made of eternal bronze and left for eternal epochs of time to “evolve” into the sleek pursuit planes, Zeppelins, or streamlined trains of today — and nothing would happen. Nothing could happen until the technique of human transportation had caught up with human restlessness — and even then Science had to wait a weary while until men learned that the essence of all technical — as it is of social — advance is Design, and that Design means obedience to physical laws in the interests of greater operating efficiency, rather than submission to constantly changing “fashions” in the interests of novelty, sales, profits, or what have you.

Getting back to the story:

Daniel C. Sayre, whom we have already quoted, tells us that “an ideally streamlined body, something like an airship in shape, and of the same frontal area as an automobile, would encounter only about a tenth as

much air resistance as the average automobile encounters now." He very sensibly adds that such perfection "is probably beyond the possibilities of this finite world," not only for reasons of "style" but also because a 90 per cent gain in efficiency would be appreciated only at far higher speeds than are demanded in routine driving — or on present highways. A further technical difficulty, and one from which the airplane is free, lies in what is called "underbody turbulence": the peculiar type of eddies and currents set up between an irregular road surface and the lower part of the car. Walter Dorwin Teague, Jr., son of the well-known designer, W. D. Teague, and himself a keen student of these, and related, problems, has pointed out that the mathematical and physical factors of underbody turbulence are far from being solved, and that the necessity for a minimum clearance between the road and the lower part of the chassis will impose permanent limitations upon streamlining for any form of vehicle that travels on land. Enclosing the exposed chassis parts might help, but to do so would entail further engineering problems connected with ventilation, oil and fuel supply, emergency repairs, etc.

EFFECTS OF WIND AND AIR CURRENTS

Actually a sedan automobile of the type which most of us see, drive, or ride about in, is wasting a full half of its power at 30 miles an hour in overcoming wind resistance. Nasty little air currents churn around the radiator, maul the windshield, whistle along the protruding fenders — and whirl in a thousand suction vortices behind the truncated rear end. Increase the speed to 70 miles an hour and five sixths of your gasoline bill is paid out for the same purpose. No wonder streamlining, from golf sticks to transatlantic liners, has become more than a passing fashion! Fuel and lubricating costs alone would compel such developments: as may be realized from the fact that, in order to increase its average rated speed by *two knots* the great Italian liner "Rex" had to increase its daily fuel oil consumption from around 700 to 1100 tons of oil. This meant a fuel cost alone of \$5000 a day, spent in the work of churning

up wind and wave around the colossal hulk!

Current streamline practice in automobiles is somewhat retarded by public hostility toward revolutionary innovations. To this must be added the high economic cost of redesigning machinery and factories to produce acceptable streamline models. Nevertheless, a manufacturer here and there is moving toward this end and, thanks largely to the airplane, things are getting better. One of the great pioneers of aerodynamics, Gustave Eiffel (none other than the builder of the famous Eiffel Tower) began, twenty years ago, to study the effects of air and wind currents on automobiles, locomotives, railway coaches, and primitive airplanes. For this purpose he built perhaps the first of those "wind tunnels" which today are scattered all over the world — we in this country, in the Daniel Guggenheim Foundation, have one of the finest — and from which we have learned so much about how to improve our transportation. Much later the British Admiralty, seeking for the best models to use in constructing airships (and submarines!), investigated the life habits of numerous aquatic animals, from tunny and salmon grilse to the blue whale. From these studies the fact emerged that the finest examples of natural streamlining were to be found in the last-named — and in the shark: both of these, their lines somewhat rearranged, were adopted in experimental automobiles.

PROBLEMS OF AUTOMOTIVE ENGINEERING

A very thorough research on the automobile, based on wind-tunnel measurements, was conducted by R. H. Heald, of the United States Bureau of Standards. Mr. Heald took six small-scale models of motor cars: a 1922 sedan, 1922 touring car, 1928 light sedan, 1933 light sedan, and two models constructed according to streamline principles. Measuring the wind resistance on each of these models at a standard velocity, the following "drag coefficients" were determined: 1922 sedan, 0.0017; 1928 sedan, 0.0018; 1933 sedan, 0.0014; streamlined model, 0.0005. In other words, a car designed according to correct aerodynamic principles is nearly 350 per cent more effi-



© Norman Bel Geddes & Co.

(Above) Norman Bel Geddes has designed this model of a streamlined ocean liner. Though it is intended for the surface of the water, it is interesting to compare its shape with that of the leopard seal at the right

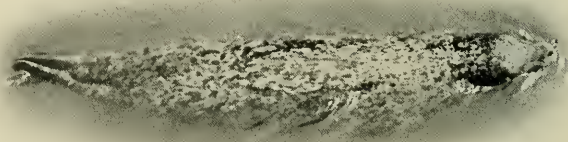


Photo by Robert Cushman Murphy



© Norman Bel Geddes & Co.

A few years ago the Norman Bel Geddes streamlined model train at the left would, no doubt, have seemed more extreme than it does now, for somewhat similar trains are already in operation

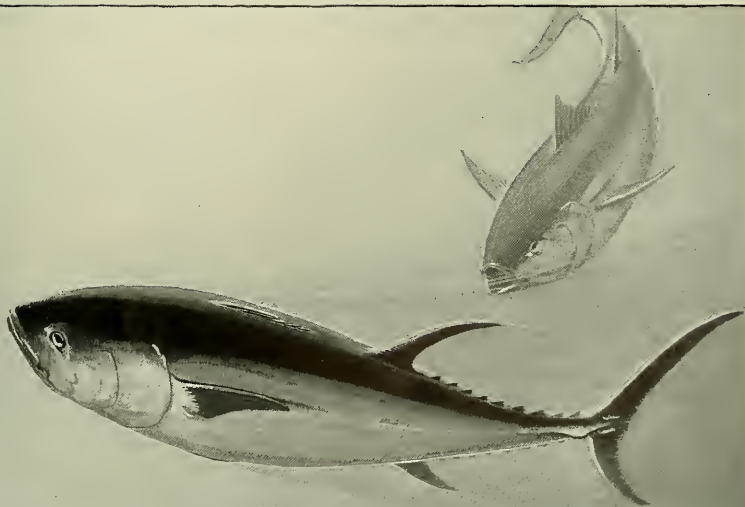
For the most part, streamlined automobiles are not streamlined at all. The model car shown at the right, designed by Norman Bel Geddes, is, however, a suggestion of what must ultimately be done in the matter of automobile design. A major difficulty arises from the fact that automobiles properly designed, for instance, for travel against the wind, are improperly streamlined when the wind blows from any other direction



© Norman Bel Geddes & Co.



The killer whale at the left and the tuna below are outstanding examples of Nature's streamlining. The tuna is the more remarkable, for, at high speeds, the spinous dorsal, the pectoral, and the ventral fins fold against the body



© D. M. BLARELY.

cient in overcoming air resistance than a stock model of eight years ago! Translating the mathematical expressions into more readily understood terms of horsepower, the Bureau of Standards investigation means that at a given speed of 60 miles per hour, power consumption works out like this: 1922 sedan, 27 HP; 1922 touring car, 33 HP; 1928 sedan, 26 HP; 1933 sedan, 18 HP; *two streamlined models, 8 and 6 HP* — a 300 per cent gain in efficiency over the best of 1933's cars, and nearly 600 per cent over a heavy 1922 touring car. It must be remembered, of course, that these were essentially laboratory tests: operation under actual road conditions would considerably change these ratios. But, as the changes would affect *all* the models, the relative superiority of the specially designed models would remain. Nor must one forget another disturbing factor in attaining high speeds: "Cross" or "quartering" winds. On this subject the analysis made for the writer by W. D. Teague, Jr., is worth careful attention, for it clearly summarizes one of the best-known problems of automotive engineering.

Mr. Teague states:

One difference in the streamlining of an automobile and an airplane is the effect of "cross winds," or wind currents striking the car from various angles in front. A perfect teardrop shape is designed for maximum efficiency when moving straight ahead, but it is not the most efficient shape when moving in any other direction. When a wind strikes an automobile from a quartering angle, the result is the same as if there were no wind and the car were moving partly sidewise.

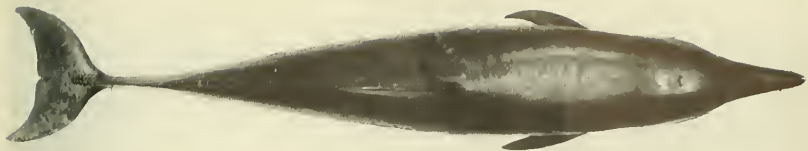
This difficulty, of course, is reduced to a minimum with a properly streamlined submarine moving at depths below the turbulence range of waves, or with an airplane "schooning" at high altitudes. In each case the vehicle is completely surrounded by an elastic medium as nearly homogeneous as it is possible to realize, and the chief problems of the designer are those of weight distribution, power plant, surface area (which includes all excrescences) and "skin friction" — the unavoidable rubbing of the vehicle's body against the contact layers of the medium.

Thanks to the tremendous development of commercial aviation the whole problem

of mass-transportation both on land and water has been torn wide open. The great shipping lines are fighting desperately to regain a passenger traffic which is, as yet, but slightly threatened by trans-oceanic air service though, paradoxically enough, they are doing this on the basis of size, paying far too little attention to the basic problems of design. Norman Bel Geddes, whose ideas on streamlining are so advanced that many practicing engineers tend to smile at them as fantastic, has drawn up plans for liners which resemble nothing so much as gigantic dolphins, blunt-nosed, absolutely smooth sides, with long, tapering tails and finlike funnels clipping the air. He claims that a full-size, 70,000-ton, 1000-foot ship built according to his specifications could achieve a 20 per cent increase in speed over the orthodox design, adding $5\frac{3}{4}$ knots to the present average rate, thus clipping 22 hours from the cruising time between New York and Plymouth. The streamline features are believed to reduce the factor of wind resistance by as much as 14 per cent — and this gain would be increased in bad weather owing to the general structure of the ship. Furthermore, Mr. Bel Geddes claims that the costs of construction — as well as of operation — would be considerably less than at present.

Possibly. But in the time it would take for the shipping companies to effect such drastic, and costly, changes in their existing practices, and to "educate" a traveling public to cross the ocean in the new contraptions — in that time trans-marine air traffic might have become a reasonable possibility.

On land, however, there will always be the railroads: though, on this subject many a railroad executive, scanning his year's balance sheet, has bitter doubts. From nearly 47 billion passenger miles delivered by the railroads of this country in 1920 to less than $16\frac{1}{2}$ billion passenger miles in 1933: a decline of nearly two thirds in fifteen years — that makes a railroad tragedy of the first order. Couple this fact with an *increase* in automobile registrations during the same period of from $8\frac{1}{4}$ to more than 23 million — a 250 per cent increase — and you have one of the reasons for this tragedy.



The porpoise above again illustrates Nature's streamlining, while the dirigible at the left probably illustrates one of the most perfectly streamlined forms that has yet been developed for practical use by man

Official Photograph, U. S. Navy

Aeronautical Chamber of Commerce of America



Union Pacific Railroad Photo



The Union Pacific train shown above has been so designed as to eliminate a large part of the wind resistance encountered by trains of usual design. The New York Central locomotive shown at the left has been fitted with a partly streamlined covering in order to accomplish a similar purpose. That such changes in shape are beneficial is not to be questioned

New York Central Lines

One way out is: move less traffic at higher speeds and less unit cost, over greater distances in less time. This solution leads as straight as an arrow to an assorted collection of technical improvements, of which streamlining is by no means the least important. Result: what Henry F. Pringle has called "Tomorrow's Trains," and what not a few of us have seen, pictured or in reality, in the Burlington "Zephyr" and in the Union Pacific 80-ton, six-car aluminum unit now in active service. Regarding this latter achievement of modern land transport, we can do worse than listen to the aeronautical engineer who supervised the wind-tunnel tests on which the final blueprints were based and in whose opinion the new train "has possibilities of power economy not possessed by any other known vehicle." He wrote:

The new train will require 500 HP to propel it 90 miles per hour with a load of 120 passengers and 25,000 pounds of mail and baggage. The ten-car conventional train which it replaces [average weight, 1000 tons] carrying the same load at the same speed, requires 3400 HP; a three-car conventional train requires 1700 HP; six buses, similarly loaded, same speed, 1500 HP; 30 automobiles, 3600 HP; a steam river-boat, 211,000 HP; and 13 transport airplanes, 5000 HP.

For each of the 120 passengers on a ten-car conventional train the locomotive has to pull an additional weight of 8.3 tons, at an average total operating cost of one dollar a mile, and a power expenditure per passenger of 28.3 HP. Enter the engineer with carte blanche to design and construct a practicable transport unit running on its own track by electric power supplied from its own Winton-distillate engine power plant. Each passenger can now travel, at the same speed, on considerably less than five HP, carrying with him additional weight of about *seven-tenths of a ton*, with a total operating cost which should not be much in excess of forty or fifty cents a mile. (The fuel burned in the Union Pacific, and similarly designed trains, will not cost much more than four cents a gallon — and one

gallon will drive the unit, fully loaded, for something more than a mile.)

No wonder the railroads are waking up to some of the laws of Nature, as exhibited in the phenomena of *aërodynamics*! Those companies which are not yet able, or willing, to make 100 per cent changes in their present equipment (much of which, be it remembered, has still to be paid for — and pay for itself) are messing around with minor changes, like the New York, New Haven and Hartford with its redesigned coaches. And builders of steam locomotives — notably the American Locomotive Company — are doing their best to reconcile the discovery of James Watt with the imperatives of the *aërodynamic* engineer: with every chance of at least moderate success, according to the already completed designs of the above-named Company: which is convinced that a properly streamlined steam locomotive can attain speeds of 90 miles per hour with an over-all weight per passenger of about 500 pounds!

THE SECRET OF SPEED

It is curious to reflect that Man, who is always in a hurry, should turn for the secret of Speed to Nature, who will consume centuries and æons to complete one of her countless voyages through the worlds of matter, animate or inanimate. But, even in Nature, there is a tendency to finish whatever task is under way with a minimum expenditure of energy, materials, and time: this despite the apparent "uselessness" of the final result. Physicists, thinking of the ways of light, electricity, gravitation, have given this tendency a name: they call it "the Principle of Soonest Arrival."

The whole secret of Streamlining is in those words. To arrive first, in a world consumed with the passion for Speed, travel the shortest route in the briefest time. To do these things *efficiently*, reduce to its minimum the resistance of the medium through which you are traveling. In other words, once more: Back to Nature!

Nesting Days

With the return of spring the bird world reawakens, offering the nature photographer infinite opportunities for fascinating observation

BY ALFRED M. BAILEY

Director The Chicago Academy of Sciences

Photographs by the Author and F. R. Dickinson

WHEN drizzling rains of late March have melted the last of the winter snow, the first of the winged migrants makes a leisurely appearance. There will still be many cold days; the forests are drear and the leaves soft underfoot; there is a bite to the steady wind, but here and there in sheltered places, green growths are pushing aside protective mantles. Hardy bluebirds, robins, and meadow-larks have arrived to join the scattered wintering birds, and their cheery calls seem to promise better days ahead. As March progresses into April, many of the seed-eating birds find an easy living under the receding snow. The song-sparrow no longer skulks amid a tangle of vines and grasses, but makes known his joy of living from a prominent perch, while troops of fox sparrows and towhees invade the territory of the resident cardinals.

The great horned owls have long since hatched their youngsters in some towering cottonwood or pine, for they are hardy fellows; they had eggs in late February and now large fuzzy young may be seen huddled together on some outstretched limb, gray against dark shadows, awaiting the arrival of their parents carrying some unfortunate small mammal. Pugnacious fellows are these young horned owls, with glaring yellow eyes and snapping beaks! They threaten dire punishment to the photographer, but their bold front is mere pretense, for they have little strength, as yet, in their great talons.

When we wander through the dank woods in early April and are greeted by the new arrivals, we see many of our wintering guests, of course, and we occasionally hear the wild far-reaching calls of red-shouldered or red-tailed hawks as they cruise high overhead, scanning the world below. What

wonderful eyesight they must have to see the small furred creatures upon which they feed! A few have been with us all winter, but occasionally, at this time of the year, one will circle overhead, calling querulously, anxiously, and we know that a nest is near. A platform high up in a tree must be the nesting site; with the glasses we see a solid construction of small twigs with masses of dried leaves, so we pass on, for that is the home of a squirrel. But the nest is not far and we scrape our shins on rough bark as we climb to investigate; four beautifully splotched eggs of the red-shouldered hawk repay us for our visit. There is an ideal spot for erecting a photographic blind in a near-by tree and our spring work is begun.

There are worse ways of spending April days than sitting in a photographic blind, high up in a wind-blown ash. We see the bird world unobserved. Crows call near at hand while our nesting hawk sits close on her nest; nuthatches and brown creepers explore bark surfaces within arm's reach, and a downy woodpecker taps inquisitively at the framework of our blind. Fox squirrels carry on their contretemps, leaping from tree to tree, while far below us a woodchuck feeds on the fast-growing plants.

* * * * *

There came a day when our hawk did not fly from sight on our arrival at the blind; instead she circled the near-by woods, crying piteously. There was a reason, for as we shinned to the level of the nest, we saw a downy little head over the rim. We had hardly crawled within our canvas shelter before the old red-shoulder was on her nest, and with drooping wings and raised crest, hurled invectives at the creatures taking refuge in the blind.

We came to know Lonesome Willie well, in the days that followed. He was named "Lonesome" because he was the sole survivor of two that hatched. Willie grew rapidly on a diet of small mammals, gar-



*The spotted sandpiper settles upon
its protectively colored eggs among
the flowering dogwood*

*(Left) The pied-billed grebe eyes
the photographer from behind a
tangle of last year's growth*

*(Below) The killdeer attempts to
hatch a golf ball — an ambitious
but futile task*





The long-billed marsh wren totes bugs to its youngsters, concealed in the domelike nest

(Right) Least bitterns nest on fragile platforms in the tule marshes and feed their fast growing youngsters upon frogs, crayfish, and other small marsh animals

(Below) When crayfish mounds line the shores of the marshes, it is a sign that the kingrails have started housekeeping



nished with an occasional writhing garter snake, and it was not long before he would walk about the nest, now and then rising to his full height, flapping his wings as he took his morning exercise. When crows came near, Willie flattened out in the nest and remained motionless, and every morning, when the mail plane came droning low over the woods, Willie would crouch until the roar of the motor became fainter and fainter and finally died away in the east.

WOODCOCK

One morning in April, when spring beauties sent waves of color rolling through our wood, and the bushes were tinged with green, we flushed a timber-doodle, that quaint relative of the shore birds that depends for his protection on his coloration and a fast getaway, when closely pressed. This old man of the woods, the woodcock, was so inconspicuous we nearly stepped on him before he burst from underfoot. We knew his bride must be in the near vicinity, so we searched carefully in likely spots, and finally located her crouching on her eggs. Her colors were those of the forest floor, beautiful feather patterns that matched the subdued values of the fallen leaves. Only her beady black eyes, watching intently, betrayed her.

And so, from the time of our earliest nests in March, we find something of interest afield. April is well along and the migrants are passing through to distant breeding grounds and the forests and fields are ringing with the notes which bring back memories of other spring days with companions who no longer share our pleasures. The song of the redwing in the ice-bordered marsh, the whirl of wings of the spoonbills, pintail and blue-winged teal as they break from the edge of the little cat-tail pond, and the chorus of unseen frogs, are all events of the day. The bobolinks adorn the open fields; they have just returned from distant Argentine and Patagonia. The beautiful black-and-white males are conspicuous upon dead reeds, while their modestly dressed mates seek favorable nesting sites in the newly grown grasses. The brown thrushes and catbirds build along the hedgerows or among the blossoming crab

apples; they are not shy, they sing the day through, having as varied a repertoire as their relative the mocking bird. And while our summer residents are starting house-keeping, the little strangers are continually passing onward; small warblers of many species, vireos, and flycatchers.

As April is the month when winter turns to spring, so May is the month when spring changes to summer. It is the month of travel and homemaking. Our little song sparrow still sings from his prominent perch, but not far away, in the tangle of grass and fallen branches is a loosely constructed nest, to which the little brown-striped female makes continuous trips, toting bugs of monstrous size to plug the wide open maws of the youngsters. A young cowbird is outgrowing his foster brothers, and as he has a larger mouth and longer neck, secures more than his share of worldly goods. And economists say that times have changed, that things will be equally divided from now on! Or will it work out that we, in our human affairs, will have more cowbirds and fewer song sparrows to tote bugs? Certainly it would not help the young song sparrows if the ruler of the universe should decide that because of upset conditions, we should limit production in the bug world, and reduce the supply available. The cowbirds would continue to get more than their share, due to physical advantage. No, it would seem that if our young song sparrows — human and bird — are to have an abundance of the necessities as well as the pleasures of life, we must produce more instead of less. There is a limit to what a young cowbird can consume, and his nest mates will eventually strike out into other fields where competition may not be so keen.

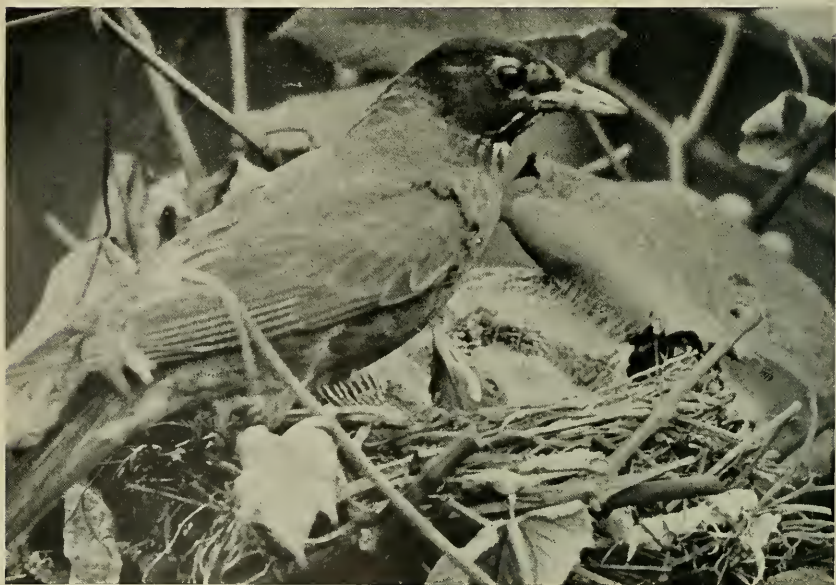
But one of the delights of rambling in early spring, if one is not of a naturally morbid disposition, is that he can escape from human cares. It is not necessary to draw comparisons between our petty troubles and those of the creatures of the wild. When we hear from a roadside marsh the "couch-ar-ree" of the redwing, a bird full of joy, we may be sure that there are many other species in the same wet area and that there will be a wealth of interesting material

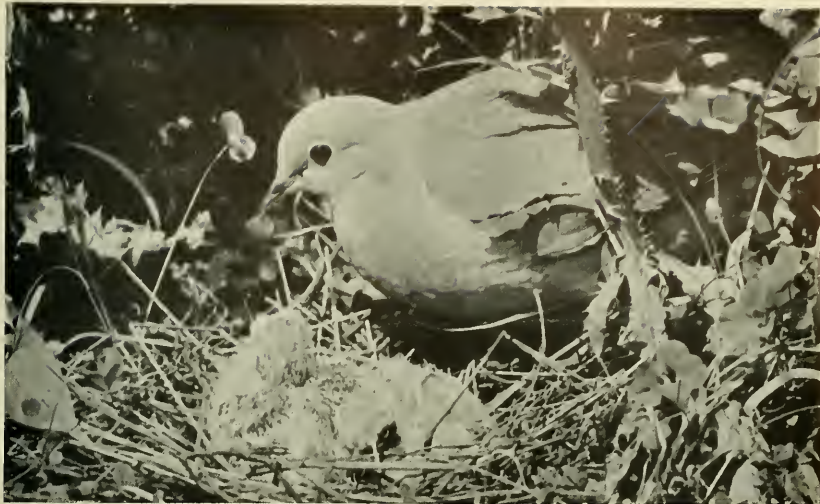


The woodcock (shown above) is an inconspicuous bird with colors like those of the forest floor, beautiful feather patterns that match the subdued values of the fallen leaves. Only the bird's black eyes are prominent. (Left) The ruffed grouse upon her eggs matches the high lights and shadows of the surrounding vegetation. Fortunate indeed is the wanderer who discovers one on its nest



(Above, left) The kingbird tolerates no invaders in his domain. (Above) The flicker pauses at the nesting entrance. (Left) The nests of the touchees are hidden among the shadows. (Below) The robin, a favorite harbinger of spring which is well known to all





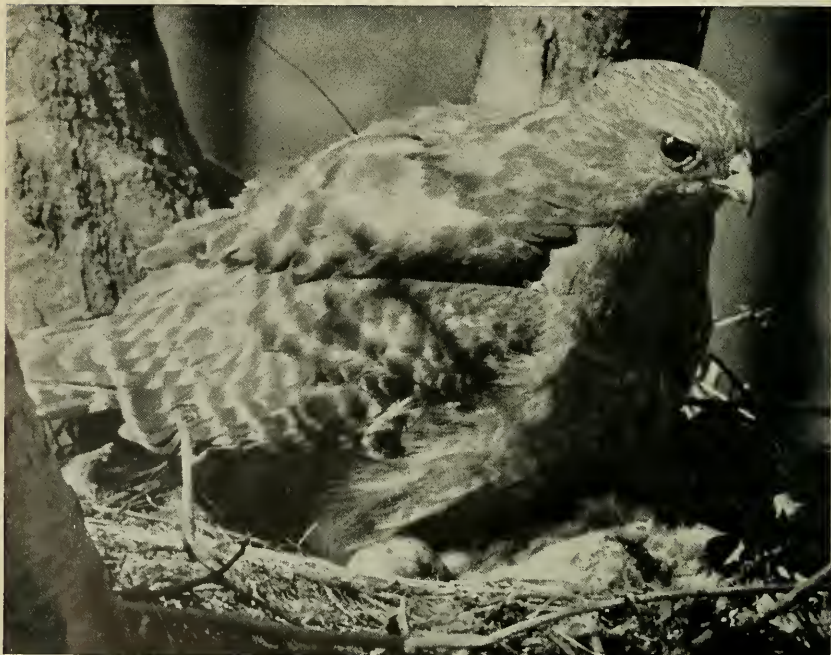
(Above) Mourning doves occasionally build their homes upon the ground. (Right) Orchards are favorite haunts of the cedar waxwings. (Below) The vesper sparrow dwells on the ground. (Below, right) Prairie horned larks are seen about such open spaces as golf courses





(Left) The screech owls nest in the willow stubs along a meandering stream. The melancholy calls of these birds seem to come from all parts of the woods

(Below) The red-shouldered hawk is a beneficial species, for it feeds its young almost exclusively upon small mammals, with an occasional garter snake for dessert. The nest is usually placed in a crotch of a tall forest tree



to study. On warm days in early May when the rapidly growing cat-tails are a foot or more in height, we find the painted terrapins and water snakes sunning themselves on water-soaked logs, the frog chorus is at its height, and along the shores of our little pond we find mounds where the crayfishes have deposited mud from their tunnels.

We know that the pied-billed grebes are nesting though we have failed to see a bird, for these shy creatures are adept at hiding. Near at hand, partly concealed among the marsh growth is a small floating mound, like the submerged top of an old muskrat house. Carefully removing the debris we find the dirty white eggs of an "hell-diver." The old bird had concealed the eggs when we splashed into sight, and even now, is undoubtedly eyeing us from behind a tangle of last year's growth. A short distance away, well hidden in a mass of old reed is the nest of a coot with eight speckled eggs, and the old one protests plaintively from a distance. The marshes are a delight at this time of the year for there is an abundance of life to be found in a limited area; there is no difficulty in discovering the homes of the nesting water fowl. On her little reed platform an American bittern sits motionless with long neck and beak extended upward so that she resembles the stalks of the surrounding plants. Her bright yellow eyes watch every move we make, but if we pretend that we have not seen her, we may walk within touching distance.

Our little grebe and the coots do not object to our prying into their affairs, however, and soon after we have concealed ourselves in a little canvas shelter, they come from their hiding places, timidly advancing toward their nests.

A few weeks later, well after the middle of the month, when the tules and cat-tails are well along, we find that the rails have started housekeeping. When we saw the crayfish mounds along the shore, we knew the king rails would be nesting, as well as their smaller relations, the Virginia rail and the sora, for the crawfish is a preferred article on the menu of these wary creatures. These birds present no problem to the

photographer, however, for though they skulk timidly among the water plants, they do not seem to mind a photographic blind and return quickly enough when all is quiet, even though it has been erected in their very dooryard. We have no difficulty in recording their nesting activities.

The marsh dwellers are now in the midst of their housekeeping. The black tern and Forster's tern deposit their eggs on frail masses of decayed vegetation, and while one incubates the splotched eggs, the other cruises over the gleaming waters, in company with many of his kind, searching for food and finding fault with all the other inhabitants. In fact, it seems to be a habit of the majority of marsh-nesting species to be intolerant of their neighbors. The tyrant kingbird living in the willow overhanging the water tolerates no invaders in his domain; no hawk or crow is going to pass his precincts without being hurried on his way by vicious onslaughts from above. Even the tiny long-billed marsh wrens, busy carrying bugs to youngsters concealed in domelike nests, resent intrusion. They protest violently if the least bittern, gliding through the tangled vegetation, ventures too near their home. This little heron is inoffensive enough; he is merely returning to his nesting platform with its awaiting chicks; he is heavily laden with small frogs, fishes, and other delicacies which he has caught and swallowed, and the young epicureans are impatient for his arrival. So there is no reason for violence on the part of the wrens; it is merely that the various pairs of birds have title to a certain amount of ground and trespassers are warned that they poach on the hunting preserves at their own risk.

And so, we find the activities of the birds of marsh, forest, and field at their height. During the fall and winter months they lived a carefree life, but now they are tied to one locality by that instinct which impels the individual to attempt to perpetuate its kind. They are no longer free agents, they must remain at home, and consequently, if we desire to become acquainted with our feathered neighbors, the time for us to roam afield is in the spring and summer, when the days grow long.

Building a Super-Giant Rhinoceros

The problems encountered in reconstructing from fragmentary remains the skeleton of Baluchitherium, a gigantic, prehistoric rhinoceros

BY WILLIAM K. GREGORY

*Curator, Department of Comparative Anatomy,
American Museum*

Contrary to a widespread popular belief, scientists are unable to reconstruct an otherwise unknown animal from a single bone. The following article gives some idea of the difficulties encountered even when many bones are available, though the varying sizes of the individual animals from which, in this instance, the bones came, complicated the matter considerably. That they have been able, however, to reconstruct a "new" animal of extraordinary size and unusual interest is obvious. The scientific results of this work are being published by Walter Granger and William K. Gregory in the American Museum Novitates and Bulletin. — THE EDITORS.

EZEKIEL'S vision of the valley of dry bones came again in our days to Henry Fairfield Osborn, who prophesied concerning the valleys of dry bones in Asia. And he sent thither his young men, the keepers of his behemoths and the masters of his leviathans, and they went forth into the desert places. And when they went down into the valleys of the desert, lo, the bones were buried in the rock. And they searched far and near and looked hither and thither, and behold, the valleys were full of bones, and lo, they were very dry. Then the prophet girded up his loins and went down himself after his young men into the valleys of dry bones. And he came upon a small bone by the roadside and he prophesied and said: Thou shalt be called *Eudinoceras*, because thou art the father of all those whose horns are exalted upon their foreheads. And the bone answered and spake unto him, saying: "My lord, thou sayest it." And he prophesied again and said: "Come forth, O bones, from thy rocky sepulchres!" And lo, there was a sound as of many picks and spades and the bones came forth out of the rocks and the bones came together, bone to his bone. And when he had prophesied yet again they stood up upon their feet, like unto giants. But the greatest of them all was *Baluchitherium*.

Dropping the parable and coming down

to the dry bones of fact, we may begin our chronicle of *Baluchitherium* with the year 1909, when Mr. C. Forster Cooper, then a graduate student of Cambridge University, came to New York to spend a year studying palæontology at the American Museum of Natural History under Prof. Henry Fairfield Osborn, and caught the vision of the valleys of dry bones in Central Asia. Thus it was that Mr. Forster Cooper was willing to risk exposing himself to the usually accurate marksmanship of the vigilant tribesmen of Baluchistan for the sake of opening up to science their undiscovered palæontological treasures.

Accordingly in 1910 and 1911 he made two journeys into Baluchistan and succeeded in finding and bringing out a number of new and important fossils, including the jaws of some very large extinct species of rhinoceros and a few bones of truly Titanic size and unknown provenance. The enormous atlas vertebra of this form somewhat resembled that of a horse and so did the middle bone of the forefoot. The astragalus, or pulley-bone of the ankle, however, was more like that of a rhinoceros, while the huge thigh bone in some ways suggested that of an elephant. Most remarkable of all, the sixth vertebra of the neck was so big that, when boxed, it made a full load for a camel. Although in some features re-

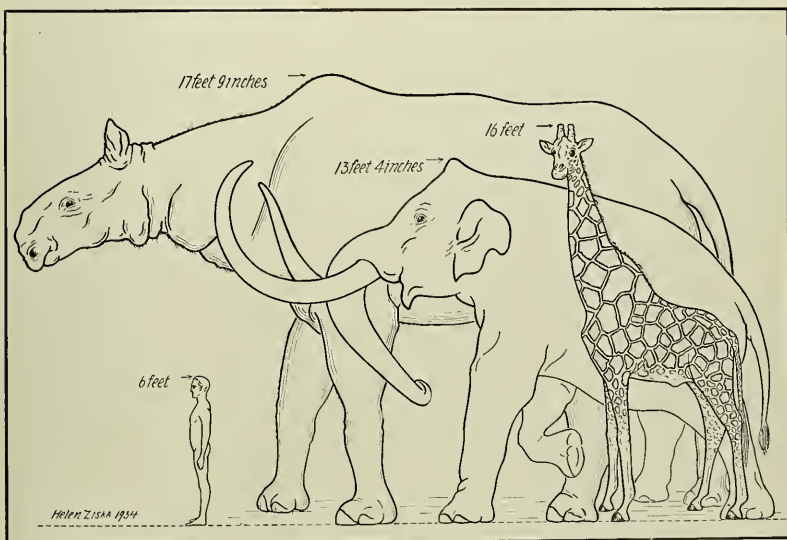
sembling that of a horse, it had great "caves" on either side of the centrum, or basal portion, beneath the tunnel for the spinal cord. This was a feature hitherto unknown in the vertebrae of mammals but common in the vertebrae of the huge sauropod dinosaurs. Mr. Cooper considered these "caves" as adaptations to secure lightness combined with strength, and they were obviously not indicative of relationship with dinosaurs.

On the basis of these and other facts he rightly concluded that he had discovered a new member of the ancient and honorable order of Perissodactyla (odd-toed hoofed mammals, including tapirs, rhinoceroses, and horses); but he believed at that time that the giant was also quite distinct from the rhinoceroses although perhaps remotely allied with them.

Since it was his well-earned right to give

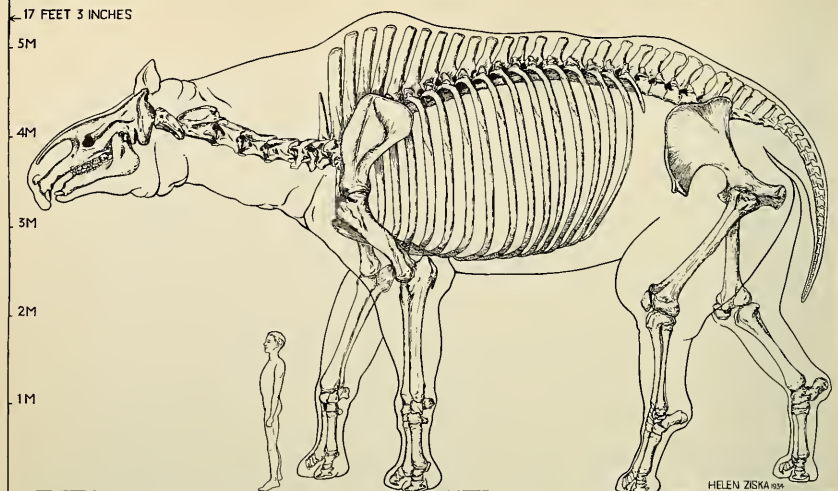
a name to this extraordinary animal, he named it *Thaumastotherium osborni*, literally "Osborn's Wonder Beast," in honor of his friend and teacher. It was soon pointed out to him, however, that the name *Thaumastotherium* had already been "preoccupied" for another fossil and was therefore unavailable according to the rules of nomenclature. He accordingly changed the name of the genus to *Baluchitherium*, the species remaining as before.

In 1914 a Russian soldier who was also a student of geology discovered some Titanic fossil bones in Turgai, a part of Russian Turkestan, and these were eventually collected and set up in the Moscow Museum and described under the name *Indricotherium asiaticum* in 1915, 1922, by Professor Borissiak. This material included a palate with well preserved premolars and molars, which showed beyond doubt that *Indrico-*



A Comparison

This drawing, made to scale, shows the comparative outlines of the largest *Baluchitherium* (as restored), the largest fossil elephant (*Archidiskodon maibeni*), and a large modern giraffe. Drawn by Mrs. Helen Ziska



The restoration of the skeleton of Baluchitherium, as completed by Walter Granger and William K. Gregory. Drawing by Mrs. Helen Ziska



The small bone shown at the left in the photograph above is the middle metacarpal bone from a modern white rhinoceros. The others are the corresponding bones from a small, a large, and a super-giant Baluchitherium. The largest of these is twenty-five inches in length

therium was a giant rhinoceros, related more or less closely to the earlier hornless rhinoceroses of North America. Later evidence indicated that *Indricotherium* is at least closely related to *Baluchitherium* but the crown pattern of its fourth upper premolar is slightly more complex.

In 1922-30 the Central Asiatic Expedition under the leadership of Roy Chapman Andrews, with Walter Granger in charge of palaeontology, found many scattered bones of *Baluchitherium* at various places in the Gobi Desert. The most outstanding find was an incomplete skull, about four feet, three inches, in length, which was described by Professor Osborn in the *American Museum Novitates* (No. 78, May 25, 1923). In this article a preliminary sketch restoration of the skeleton was attempted, in which Forster Cooper's specimens of neck vertebrae and limb bones were combined with the new skull. The rest of the backbone was conjectural, as well as the length of the neck, the height at the shoulder, and the total length of the animal.

In 1933, when the last of the huge *Baluchitherium* bones had been cleared of the matrix, Professor Osborn generously placed the entire collection in our hands for comparative study, together with casts of the most important specimens of Forster Cooper's and Borissiak's material, which had been presented to this Museum in exchange for casts of our skull. We also had constantly before us the well illustrated memoirs of Forster Cooper and Borissiak. Our special purpose was to gain a more accurate knowledge of the skeleton as a whole and to attempt still another provisional restoration of the skeleton which may serve until future discoveries make possible closer approximations to finality.

For nearly a year we struggled with this problem of evolving a consistent restoration of the skeleton out of many odd lots of bones belonging to what, for the sake of simplicity, we finally graded as sizes I, II, III, IV, in descending order. We found eventually that if we multiplied the length of a given bone of No. IV size by 1.4, it would equal the known length of a corresponding bone of No. I size, and that even our No. II grade bones had to be en-

larged by 20 per cent to fit with our No. I bones. All the drawings of the individual bones were made to one fifth natural size and the smaller grades were then enlarged by the appropriate factor. But, when all this was done, we still had to make hypothetical restorations of a good many of the vertebrae, we had to determine the probable height of the animal at the shoulders, the length of the neck, the distance between the fore and hind limbs in the standing pose, the height at the pelvis, and many other important measurements. Literally scores of trials were made, checked back and forth against the available facts and then rejected or modified. In other words, the method of trial and error was followed through long and often discouraging months. A less willing and indefatigable artist than Mrs. Helen Ziska would have balked at filling many portfolios with trial drawings, while a less skillful artist could not have fitted together so convincingly the drawings of bones of originally different sizes.

In the later stages of the restoration we began to pay attention to the probable outlines of the body, with due regard to certain given anatomical landmarks that were visible in the bones. Here we reasoned that since the teeth and many individual bones show that we have to do with a fairly primitive rhinoceros, it is highly likely that the skin characters and even general contours were at least distinctly suggestive of a generalized rhinoceros type, but with long limbs and a relatively small head. In fact, our restoration is more definitely rhinoceros-like in almost every feature than were the restorations either of Borissiak or Osborn.

In conclusion, we expect to hear even many times more the oft-quoted remark of the farmer who said of the giraffe, "There ain't no such animal." And we likewise expect to be told that the head in our restoration is impossibly small, the neck not long enough to reach the ground, the scapula absurdly small, and so forth *ad lib.* But although welcoming constructive criticisms, we respectfully invite qualified critics to spend a year or two in making a new and better restoration from the same material.

Trailside "Talking" Pools

How a stream and a series of pools have been made to tell their own story and the stories of the life that they support

BY WILLIAM H. CARR

*Assistant Curator, Department of Education, and
Director, Trailside Museums, Bear Mountain, N. Y.*

THERE is a quiet brown pool, in the woods, where our Nature Trail passes. Hemlock branches shade the water, and a compact growth of dogwood, sassafras and witch-hazel screens it from a great highway that runs near by. The little pool is fed by the deep waters of Hessian Lake, lying above in the shadow of Bear Mountain. The overflow journeys onward and down to meet the Hudson River less than a quarter of a mile away.

This small body of water is a very important exhibitional feature in the scheme of the Nature Trails and Trailside Museums which have been operated for the past eight years by the American Museum of Natural History in coöperation with the Palisades Interstate Park Commission. Many animals are born and nurtured in the still water. Numerous plants line the pool's margin, attracted and sustained by the moisture upon the banks. In our attempts to tell a rounded story of the natural history of the region, for the benefit of thousands of visitors, we have exploited the brown pool in many ways.

To us the pool represents not only a graceful spot of natural beauty, a cool retreat on warm summers days, but also a place where we may secure specimens for our aquariums and food for various captive animals. We have placed labels here to tell strollers of the life to be found in the pool and, in addition, have outlined upon other labels a brief account of the work of small ponds and streams in general.

Of the many hundreds of similarly attractive pools in the confines of the Palisades Interstate Park, this one alone has been singled out for informational purposes. It is a "talking" representative of all the others. When we print signs about the pool, we realize fully that our writing is far less eloquent than the language of the pool it-

self. Nevertheless, we also know that nine out of ten of our visitors will fail to observe the pool in any objective way unless we make some attempt at interpretation.

From the standpoint of visiting children and adults, we have discovered that of all the pool inhabitants, none hold more exalted rank than the frogs. They possess, in a remarkable way, the key to the very spirit of both running and quiet water. Ever alert, ever watchful, they are symbols of the pool's mystery. The pool is their host and they its regiments of humble, loyal dependents. These wearers of glistening green and black and gold provide not only color and action, but also, at certain seasons, give musical performances against the perpetual background of the singing stream above.

Nearly all of our Nature Trail walkers who are in any way interested in the pool's residents are content with simply watching the green frogs and the bullfrogs. Oftentimes, however, the frogs are encouraged to jump, and sometimes our guests feel the urge to capture them and to observe, at close hand, their brilliant eyes, webbed feet, and pulsing throats.

It seems to us that we are ever observing creatures of various sorts, in direct relation to the reaction they bring about in the minds of people. It is a fascinating and endless subject for study. In this connection we have often asked the question, "Why is it that a boy can seldom be satisfied with merely looking at a frog?" It is a well known fact that he is not. Many pages could be written to tell the number of different things boys have done to frogs; and then the story would not be complete. Also, many things would not be printable.

There was a particular frog in our pool that tempted one small boy to devise a scheme for testing its actions under conditions of his own making. It was a large, comfortable bullfrog that had an amphibian personality all its own. To human eyes its outward appearance of contentment and



The artificial pools at the Trailside Museum, Bear Mountain, are useful teaching adjuncts. The turtle pool (above) with its overhanging stones, confines the reptiles in a small area. The frog pond (left) serves to bring amphibians to public attention. Photographs by Thane Bierwert

Pond

The infant painted turtle, at the left, behaves very nicely in an aquarium. However, it would probably prefer being at home in a pool such as the one shown below



Photo by Thane Bierwert

The pickerel frog below spends long hours in the grass beside pools. The box tortoise below to the right is a terrestrial wanderer



Photo by M. Peter Keene



Photo by M. Peter Keene

Life

Young pickerel are splendid aquarium exhibits. They are ever alert, vibrant, and active, feeding readily and living well and attract the attention of many visitors at the Trailside Museum



Photo by M. C. Dickerson

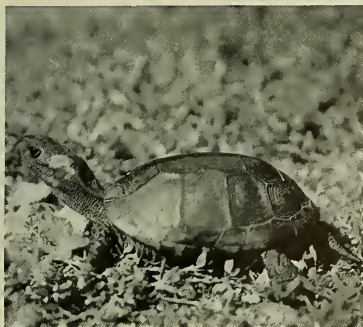


Photo by M. Peter Keene



Photo by Wilfred Miller

The watchful bullfrog below is a resident of many natural pools. The Muhlenberg turtle to the left, below, is a rare inhabitant of Bear Mountain



Photo by M. C. Dickerson

ease enabled it to present a calm, self-satisfied demeanor to all the world as it sat motionless on the grassy bank. After having watched the frog for awhile, at fairly close range, the boy conceived the notion of interfering with its unexciting peaceful contemplation of the pond. He held a light branch with a delicate twig at the end. Reaching forward very gently, he tickled the frog's head with the twig tip, expecting of course, to see the animal leap with a splash into the water as many frogs had doubtless done on similar occasion and under like persuasion. This individual, however, apparently had different thoughts than the majority of its fellows. At first, with considerable deliberation, it pushed the twig away with one of its forefeet. It had every appearance of being a dignified and annoyed old gentleman, brushing away flies.

A BEHAVIOR EXPERIMENT

The boy persisted in his tickling tactics until eventually the bullfrog, tired of "brushing," closed its eyes and with complete resignation lowered its head to escape the offending twig, but to no avail. Suddenly, the pestered one's eyes opened, up came its head, and with a lightning-like movement, it bit at the twig, caught it in its mouth, held on for a second, and then released it again.

In his amazement at the stick-biter's totally unexpected performance, the boy dropped the wand and stood gazing at the now unmolested frog. Was it any wonder then, considering the success of the "experiment," that the boy should seek new trials for his frog? If it would deliberately bite a stick, what else might it do? Near the pool's edge grew a small flower with pink petals. Picking one of the vivid petals and impaling it on a long blade of dried grass, the boy waved it gently before the frog's nose. It looked surprisingly like a fluttering insect.

The aroused frog must have had the same idea as to its appearance. It seemed a tempting insect, blown by a kindly breeze. The bullfrog watched its vibration for a moment and then, with a flying leap, grasped it in his mouth, freeing it from the grass-

blade, and calmly proceeded to swallow it! Then, as though duties called elsewhere, the frog blinked, gave a leisurely jump, and was soon swimming away out of sight beneath the water, leaving the boy upon the shore very much pleased with himself.

Youthful experiments of this sort interest us nearly as much as do the ones of learned investigators. Perhaps this is a sad admission, but it is true.

If the frogs are the nimble acrobats and witty members of the pond family, then the turtles are its placid, serious and unobtrusive dwellers in water and out. Spotted and painted turtles are at home, both in the Trailside pool and down stream in a small swamp. Despite their somewhat stolid natures, turtles are often difficult to approach, whether from the bank or from some partly submerged log.

On more than one occasion we have come upon visitors, not always young, in pursuit of our turtles. The quests have usually been unsuccessful, due to the fact that these animals are seldom caught by the employment of ordinary strategy. Usually they are more clever than the most careful of stalkers.

As a direct result of the interest shown by the public in our natural pool, we conceived the idea of building several artificial ones. It soon became apparent that the earth surrounding the small pool would be trampled to such an extent that all the near-by plants would be ruined. We also discovered that fish, and other animals too, could not be properly seen by the average guest. Aquariums in the Trailside Museum served their purpose very well; nevertheless it was our endeavor to present the animals under conditions as nearly natural as possible.

Have you ever built a fish pool on a rock? We thought that the procedure would be a simple one. A beautiful sloping ledge of granite was chosen, cleared of sod, and the work commenced. Flat stones were selected and an excellent stone mason, with several helpers, built a stone wall completely around the rock. A water pipe was inserted at one end and the outlet and overflow were built at the other. The entire structure was simply a ring of concreted stones placed upon a rock.



Photograph by M. C. Dickerson

April Morning

*Of all the trees surrounding the pools in the
vicinity of Bear Mountain, the slender,
graceful, gray birches are the most
attractive*



The "ring of rock" that forms one of the Tralside pools is pictured above, and below is shown in the making. A typical series of "talking" labels is illustrated at the right. Photographs by Thane Bierwert



Once the cement had hardened, we hopefully turned on the water and awaited the result. Our minds, envisioning the future, pictured many fish swimming about, many carefully selected plants sprouting, with here a group of cat-tails and there a blue expanse of water, with lily pads floating upon the rippling surface.

Slowly the pool filled. All seemed well until the water approached the top of the surrounding stones; then with a rush, the water commenced to bubble up from the ground before the open door of our Crafts-house, some thirty paces below. There was a leak somewhere and no question about it! The exact location of the break was another matter. Quickly the outlet was opened and the pool drained. A previous search had failed to reveal any telltale bubbles that might have given some indication as to location of the source of trouble.

To make a very long story short, it suffices to say, that after many hours of patient search, and after many experimental plasterings with additional cement, the pool was again filled. This entire process was repeated three times before success attended our efforts.

Then began the search alike for fish and plants. The game warden soon brought in a milk-can filled with minnows and small catfish. Major William A. Welch presented us with a number of fine bass and our pool was stocked. Numerous journeys to neighboring ponds resulted in collections of pickerel-weed and other plants, and our new fish exhibit was in full operation.

In our efforts to confine turtles in a manner advantageous to the public, we had, at an earlier date, built several shallow pools fronting on a tall stone wall. Overhanging flat rocks ringed the water surface and prevented the escape of the hard-shelled inmates. We soon discovered that here was an instance of too much accessibility. One by one the turtles commenced to disappear. The colorful painted turtles (especially the smaller ones) no doubt found their way into several home terrariums. As a result we planted a strip of wild flowers between the path and the pool, thereby discouraging persons who were prone to "collect."

While ours was a "share your knowledge" undertaking, it was not necessarily a matter of "share your exhibits," too!

We have long since learned that it is impossible to please all of our visitors. Our only hope of approaching the millennium in this regard, is to present an exceedingly large number of exhibit types. Often we duplicate the objects used. Our principal purpose is to vary the methods of presentation.

Some persons prefer their turtles in the large natural pool, others in the small observation pool, still others in their hands, and last, but by no means in negligible numbers, there are many visitors who do not care for turtles anywhere or in anyway!

"TALKING LABELS"

Our "talking labels" are frequently the key point in our efforts to arouse interest in our exhibits. We find that visiting naturalists may consider the phrasing too obvious or too complex. Teachers, particularly those recently graduated, sometimes object to our "pedagogy." These latter ones, in their somewhat self-satisfied criticisms, are apt to use such terms as "vitalization, motivation, activation, and methodology," in connection with the wording of our labels. We find, invariably that the more experienced and learned the teacher, the simpler are the terms employed.

Inasmuch as the success or failure of a large measure of our effort depends upon the content of our guiding signs, we are intensely concerned with every expressed viewpoint of school officials. Leaders of education who depend upon knowledge, personality, and years of intimate contact with those whom they instruct are the ones who understand our problems and who offer useful advice.

There is much for us to learn in regard to label writing. When all is said and done our best instructors will continue to be the public for whom the labels are prepared.

Our "talking" pool in the woods will cease to "speak" only when our visitors lose interest in frogs, fish, toads and turtles. We have every reason to believe that it will be a permanent institution.

Science in the Field and in the Laboratory

American Museum Activities, Expeditions, Education, Meetings of Societies, and New Members

Edited by A. KATHERINE BERGER

Templeton Crocker Expedition

Having completed his studies of Polynesian peoples, Dr. Harry L. Shapiro has returned from the Templeton Crocker Polynesian Expedition. The other members of the party, which include Mr. Templeton Crocker, Dr. James P. Chapin, and Mr. F. L. Jaques, are continuing their work in the Chinchas and the Galapagos. They are expecting to return sometime in April.

Doctor Shapiro carried on his researches in the Marquesas, Tuamotos, and the Society Islands, Austral Islands, Rapa, Mangareva, Pitcairn, and Easter Island. At Pitcairn, Doctor Shapiro was able to continue his investigations of the descendants of the mutineers of the "Bounty." All the inhabitants of the island were examined. At Easter, a series of measurements on the living population was obtained, as well as a splendid collection of skeletons and a cast of one of the monolithic stone images unique to that island.

From time to time Doctor Shapiro will communicate interesting aspects of the expedition to the readers of NATURAL HISTORY.

Sage West China Expedition

With the collection of the animals and accessories for the takin group and the giant panda group for the North Asiatic Hall in the American Museum, this expedition has now been brought to a successful conclusion. Other results of the expedition are 2700 natural history specimens, including mammals, birds, reptiles, and batrachians, for the Museum's general collections. This material is en route to New York, and its arrival is expected within the next few weeks.

Fossils from Snow Hill Island, Antarctica

The collection of fossils which Mr. Lincoln Ellsworth gathered from Snow Hill Island in the Wedell Sea area of Antarctica, while his expedition waited during last December and January for favorable flying weather, arrived at the American Museum on March 1, 1935. The seven cases of specimens were immediately unpacked and laid out for review and identification. The collection is a noteworthy one and is exceeded in size only by that made by the Nordenskjöld Expedition of 1902-1903, which spent two seasons in the same region.

The fossils are Cretaceous in age. Various kinds of

ancient life are represented, such as fossil wood, corals, sea urchins, pelecypods, gastropods, cephalopods and crustacea. Most of the fossils occur in concretionary masses of a fine-grained sandstone. Frost action has been responsible in most cases for breaking these concretions open along the contour of the included fossil. Counterparts of the concretionary mass and the enclosed fossil are thus common. The effects of weathering and exfoliation are also apparent on some specimens.

Of the fourteen specimens of fossil wood, ten of them show that the fiber was pierced by the boring mollusc *Teredo*, prior to entombment. The wood has been identified as *Dadoxylon (Araucaria) pseudo-parenchymatosum* Gotham, which is closely related to the living *Araucaria imbricata*, the lofty evergreen conifers, native of South America and Australia. The presence of the holes made by the *Teredo* indicates that the wood had reached the sea before the *Teredos* worked upon it. Three of the other specimens of this fossil wood are carbonized and one silicified. They do not show the *Teredo* markings.

While the wood came from the land, all of the other fossils in the collection indicate a marine habitat. The corals are represented by two species: *Cycloseris antarctica*, and *C. larseni*; the sea urchins by one species: *Schizaster antarctica*. There are eight species of pelecypods: *Pinna anderssoni*, *Malletia penacoides*, *Trigonia antarctica*, *Thyasira townsendi*, *Trigonia regina*, *Lahillia luisa*, *Cucullea grahamensis* and *Cytherea antarctica*. There is also the cast of the interior of a large clamlike shell which has not yet been identified.

The gastropods are present in considerable numbers, *Perissoptera nordenskjöldi* being the most common. Other species are *Tubulostium fallax*, *Pleurotomaria larseniana*, *Cassidaria mirabilis*, *Cryptorhytis philippina*, *Eunacticina artowskiana* and *Amberleya spinigira*.

The ammonites are well represented. There are ten specimens of the large partly uncoiled *Anisoceras notabile* and many specimens of *Kossmaticeras antarcticum*, some of *K. bahavani*, *K. anderssoni* and one of *Gunnarites antarcticum nordenskjöldi*.

There is one unidentified form of a marine crayfish present with chela and abdominal section embedded in a concretion.

The flora and fauna of this Snow Hill Island collection indicate a warm temperate to sub-tropical climate in late Cretaceous (Senonian) time. The

conditions then were markedly different from those of today. Snow Hill Island with latitude $64^{\circ} 22' S$. now bears a small ice cap. It lies a few miles to the east of Graham Land, that ice-covered point of land some 500-600 miles south of Cape Horn, which more recently has been discovered to be an archipelago connected with the Antarctic continent.

— CHESTER A. REEDS.

Progress of the Hayden Planetarium

Rapid progress is being made on the new Hayden Planetarium. It seems probable, however, that the building will not be opened to the public until late in the summer. The outer copper dome is almost finished, as is more than half of the inner dome, which is composed of perforated plates of stainless steel. It is on this inner dome that the artificial sky is projected.

Amateur Astronomers Association

In April the Amateur Astronomers Association will hold its two regular monthly meetings. On Wednesday, April 3, at 8:15 p.m., Dr. E. E. Free will give the last in a series of three talks on "Astronomy and Astrology." The subject of this last talk will be "Is Astrology Still Useful? The Real Relations of Planets and Birth Dates to Health, Success and Happiness." On Wednesday, April 17, Dr. Palmer H. Graham of New York University, will talk on "Comets." Anyone interested is invited to attend these meetings. They are held in the auditorium of the American Museum.

During the month of April Miss Marian Lockwood and Mr. Arthur Draper, both of the department of astronomy at the American Museum, will give a series of five dialogues over Station WOR, on Tuesday afternoons from 3:30 to 3:45. The schedule is as follows: April 2—"Life on the Planets"; April 9—"Backward Glimpses in Astronomy"; April 16—"Is Our Universe Exploding?"; April 23—"Telling Time Yesterday"; April 30—"The Atom: A Miniature Solar System."

Astronomical Cleanings

The "new" star in Hercules, Nova Herculis, which has created such a furor during the last three months, has subsided, at last reports, to a magnitude of about 3.8. At one time it reached first magnitude, and since there is a difference of 2.5 times between any two successive magnitudes, it is obviously now somewhat less than $\frac{1}{2}$ as bright as it was at maximum. . . . An interesting group of sunspots, the largest in many years, was reported in February from German observatories. This group is still visible, and in March members of the department of astronomy counted three good-sized spots in one group. The spots were considerably elongated since they were near the limb, about to pass around to the other side of the sun. This particular group will again be visible ap-

proximately the last week in March and the first in April, — that is, of course, if it lasts until the sun's rotation brings the group around again. . . . 1940 is the year now set for the completion and installation of the 200-inch telescope of the California Institute of Technology. This great instrument will be installed on Mt. Palomar, near San Diego.

Planet Notes for April

Venus is the evening star during April, in the constellation Aries until about April 12, and then passing into Taurus, setting on the western horizon about two hours after the sun on April 1, and on April 30 about two and a half hours after sunset. Mars, the ruddy planet, is a beautiful late-evening object in the constellation Virgo, which rises on the first of April about the time of sunset, and reaches the meridian about midnight. Mars will be seen near Alpha Virginis, the brilliant Spica. Jupiter is also easily visible during April in the constellation Libra, the Scales, which at midnight on April 1 is about halfway from the eastern horizon to the meridian.

Phases of the Moon During April

April 3, New Moon; April 10, First Quarter; April 18, Full Moon; April 26, Last Quarter.

Children's Science Fair

The seventh Children's Science Fair, under the auspices of the American Institute in cooperation with the American Museum of Natural History, will open in Education Hall on April 7 and continue through April 14. More than a thousand exhibits made by students in the New York City schools, from the elementary grades through the senior high schools, will be shown. These exhibits are entered under ten classifications — Stars and the Solar System, Earth Studies, Plant and Animal Life, Biology, Physics, Chemistry, Conservation, Industries, History of Science, and Energy.

Museum Techniques in Teaching

The department of education of the American Museum as a part of its cooperation with the College of the City of New York has initiated a course in teacher training for seniors from the School of Education of the College. A group of seniors has been assigned to the Museum for three weeks of intensive work in observation and practice of Museum techniques in teaching. If this method proves successful the Museum expects to continue it on a large schedule in the next semester. The work is under the immediate supervision of Mrs. Ramsey and Miss Mastin of the education staff.

Cadets Guests of the American Museum

On Saturday afternoon, March 9, about ninety cadets of the Second Class at the United States Military Academy visited the American Museum.

After a brief address on the Museum's activities by Doctor Sherwood, the cadets, under the guidance of members of the educational staff, were taken through several of the exhibition halls and especially enjoyed an inspection of the department of preparation. A visit to the Museum has become an annual feature of the Academy's program.

City Educators Guests of the American Museum

On the evening of February 10th a number of prominent city educators and the curators of the American Museum were the guests of the department of education. After dinner a brief address was made by Doctor Sherwood on the work of the Museum, referring especially to its educational program. Dr. Walter Granger spoke on the exploration phase of Museum work, illustrating his remarks by a motion picture film taken in the Gobi Desert. A tour behind the scenes in the Museum followed.

Adult Education Council Meets

The annual meeting of the New York Adult Education Council was held at the American Museum on the afternoon of March 6. Seminars on "The Consumers' Interest in Adult Education — How Do We Locate It?" and "Teacher Training in Adult Education — A Discussion of Current Experiments" were attended by members of the department of education. The meeting concluded with a dinner presided over by Dr. John H. Finley, president of the Council.

Austrian Art Work Exhibited

Under the auspices of the International School of Art, a colorful exhibit of art work produced by girls from ten to fourteen years of age in the Austrian public schools was on view in Education Hall of the American Museum from March 15 to 24.

Appointment

Mr. Paul B. Mann, associate in education, has been appointed as examiner in zoology and biology for the College Entrance Examination Board for the year 1935. This is the nineteenth similar annual appointment to this committee work on which Mr. Mann represents the secondary schools of the United States. Mr. Mann was one of the seven delegates from the United States to the First International Congress on Educational Cinematography held last April at Rome, Italy.

Nature Education for Children

For the past few months the department of education of the American Museum has been assisting in a special form of nature education carried on as the Inwood Hill Project by a group of CWA teachers under the direction of Doctor Chatfield of the New York City schools. In good weather classes of children from the public schools are taken to Inwood Park, where they study nature at first hand, also

some of the geography and early history of New York. Whenever the weather is unpropitious in the morning, the children come to the Museum. Here members of the educational staff give illustrated talks on "The Indians of Manhattan Island," "The Trees of Inwood Park," and "Local Birds." The children are then taken in groups to study these exhibits in the Museum halls.

Bird Walks

On Tuesday, April 23, Mrs. Gladys Gordon Fry, known to bird lovers and students as "The Bird Lady," will open her spring series of bird and tree walks in Central Park, under the auspices of the American Museum of Natural History.

Central Park is one of the best places in the country to study migratory birds, and New Yorkers have an opportunity that many suburbanites do not enjoy, of observing many different species in a restricted area.

An early morning group will meet at six-thirty o'clock on Tuesdays and Fridays, beginning April 23. There will also be a nine-thirty o'clock group on these days. Each class period will be one and one half hours in length. The fee for the course of ten lessons will be \$12.00.

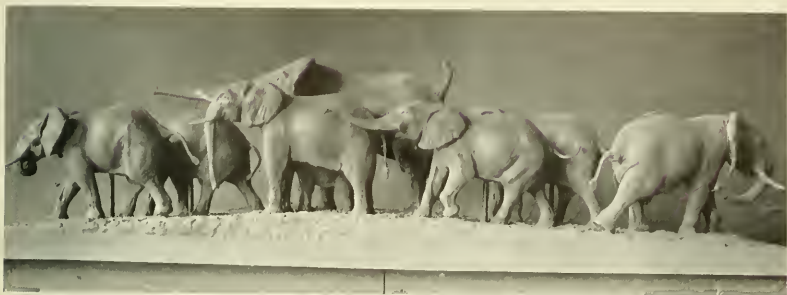
At three-thirty on Tuesdays and Fridays, a children's group will meet. The length of these class periods will be determined by the age of the children registering. The fee for this course of ten bird walks will be \$10.00. In addition, a new course for advanced bird students, consisting largely of week-end field trips supplemented by study of Museum specimens, will be offered this spring by Mrs. Fry.

The rendezvous for all groups will be in front of the main entrance to the Museum, on Seventy-seventh Street. Applications may be made to the Department of Education, Room 306, School Service Building, American Museum of Natural History, or by telephoning ENdicott 2-8500, Extension 123.

The Rothschild Collection of Birds

The Rothschild collection of birds is now being unpacked, giving promise of early accessibility to students. It was acquired from Lord Rothschild in London in 1932 and was presented to the American Museum in memory of Harry Payne Whitney by his family, but was never unpacked because of inadequate facilities for storage and display. The collection, undoubtedly the most important and the largest private one in the world, contains about 280,000 specimens, including 55,000 birds of North and South America and 25,000 sea birds.

The collection contains many genera not, up to the present, represented in the American Museum; it gives also a relative wealth of species, known heretofore only from unique specimens. Aside from the rarities, historic specimens, and birds of gorgeous plumage, the greatest resources that the Rothschild



A sketch model of the African elephant group which is to dominate the Akeley African Hall of the American Museum

collection offers to ornithology in America lie in the series of entire Old World families and lesser groups, which, by comparison with American groups, impart new meaning to the subjects of evolution and geographical distribution. It is also invaluable from a taxonomic standpoint.

Following the disposal of the Rothschild collection, the general study collections of birds will be moved to the new wing, and when this is completed, the department hopes to take possession of the offices and laboratories which are now being equipped for use.

A detailed account of this collection and the operation of transferring it from Tring to New York was given by Dr. Robert Cushman Murphy in *NATURAL HISTORY* for November-December, 1932.

Elephant Group in African Hall

Through the generosity of F. Trubee Davison, president of the American Museum, the four African elephants, collected by him and Mrs. Davison in 1933, are at last being mounted. The better part of a year has been devoted to the task of shaving and bark-tanning the skins preparatory to their mounting. As a preliminary to the tanning, the skins had to be reduced in thickness from their original inch and a quarter to a thin quarter of an inch, in order to make possible not only the easier handling of the skins, but their adjustment to the mount in natural and lifelike manner. The wrinkles and folds of an elephant's hide are strongly individual, very much as are the thumb prints of the human being, and it is therefore essential to prepare the skin so that it may be made to fit the mount as in real life.

The task of shaving these four huge skins consumed several months' time, with four men constantly at work with their fleshing knives, in order to complete the thinning over a combined area of some four hundred square feet of pachyderm.

After the shaving, the process of bark-tanning kept the still weighty skins soaking in a series of vats, with

constant turnings and testings to insure thorough and even tanning and the flexible condition of the skins at the end of the treatment.

Now, under the direction of Dr. James L. Clark, Mr. Rockwell is building the life-size armatures preparatory to their receiving the sculptor's clay, and the fifth floor preparation studios are humming with activity.

In the meantime cardboard cut-outs are being added to Akeley's original group in African Hall to determine the poses and positions of each specimen, which will insure the most practical and artistic arrangement of these big pachyderms.

Jamaica Coral Reefs

Mr. Roswell Miller recently left for a trip to Jamaica to make submarine studies of the coral reefs there. He is planning to take under-sea still and motion pictures, including some in Kodacolor.

Stalk-eyed Fishes

A small, but scientifically very important, exhibit is now open to the public in the Deep Sea Room of the Hall of Fishes at the American Museum. This consists of one of the series of growth stages by which Dr. William Beebe has shown that the stalk-eyed fish, formerly known as *Stylophthalmus* is really the young of a very different-looking fish, with normal eyes — *Idiacanthus*.

Stalked eyes are not uncommon among invertebrates, and are occasionally found in other groups of fish. These specimens show the stalk-eyed stage, and one of the later stages in which the eye stalks are shortening up. The eyes are finally drawn back into sockets in the skull, in the normal position.

The males of this species, *Idiacanthus fasciola*, are only about 38 mm. long, whereas the females are about 267 mm. long. The males have a reduced, functionless digestive tract, and no teeth; the females have a carnivorous digestive tract and large teeth.

The larval fishes were taken off Bermuda at a

depth of 100 fathoms; the adults between 500 and 1000 fathoms. The specimens are the gift of Doctor Beebe.

Pacific Flying Fishes

A fine collection of Pacific flying fishes, with a few fishes of other kinds, has been received via Valparaíso from the Templeton Crocker Expedition, and will be studied by Mr. Nichols, and by Mr. C. M. Breder, Jr. of the New York Aquarium, research associate in the department of ichthyology, of the American Museum.

Silversides

In 1923 Meek and Hildebrand described from Panama as *Mugilops cyanellus* a small fish belonging to a unique new genus of silversides. Most fishes of this family, like the one commonly used hereabouts for bait, have a bright silver stripe along the side, but *Mugilops* superficially resembles a mullet. It is very interesting to find this species represented in some miscellaneous small fishes collected in 1925 by Dr. R. C. Murphy along the South American Coast from La Plata Island and Santa Elena, Ecuador, to Talara, Peru, establishing a South American record for it.

From the other species in this collection we judge that the tropical Central American shore-fishes occur with little change along the South American coast north of Pta. Pariñas and that the characteristic Southern Hemisphere forms which make the Peruvian shore fauna distinctive occur south of that point. It is possible, however, that unusual warm weather and heavy rains which made 1925 a notable year on the west coast of South America temporarily affected the marine life of Ecuador and northern Peru. — J. T. N.

The Annual James Arthur Lecture

The James Arthur Lecture for 1935 will be given at the American Museum of Natural History, Thursday, April 25, at 8:15 P.M., on the subject of "Structural principles in the nervous system; the development of the forebrain in animals and prehistoric human races."

Following the custom established in past years, the Annual James Arthur Lecture on the Evolution of the Human Brain will be given by an internationally famous authority in the field of neurology, Prof. C. U. Ariëns Kappers, head of the department of neuro-anatomy in the University of Amsterdam. Professor Kappers discovered and developed the principle of neurobiotaxis, which is an important clue to the labyrinth of the central nervous system in vertebrates and gives us many answers as to the *how* and *why* of its intricate patterns. In addition to many technical works on the subject, Professor Kappers is the author of an illuminating treatise on "The Evolution of the Nervous System in Inverte-

brates, Vertebrates and Man," which presents this most abstruse of subjects in a form comprehensible to the lay reader.

Professor Kappers is also an outstanding authority on anthropology, especially the anthropology of the races of the Near East, where he spent several years in the American University of Beirut, Syria.

The James Arthur Lectureship is provided under the terms of the generous bequest to the American Museum of Natural History made by the late James Arthur of New Rochelle, New York. The lectures already given under this foundation are as follows: "The Brain in Relation to Behavior" by Prof. Frederick Tilney of the Institute of Neurology, Columbia University; "Brains as Instruments of Biological Values" by Prof. C. Judson Herrick of the University of Chicago; "The Story of Fossil Brains from Fish to Man," by Prof. D. M. S. Watson of University College, London.

Professor Kappers has also been invited to deliver the 34th Mary Scott Newbold Lecture of the College of Physicians, Philadelphia, and will give several other lectures in various cities of the East and the Middle West during his short stay in this country.

Early Migration of Man to America

An interesting archaeological discovery having direct bearing on the early cultural relations between Asia and America has recently been brought to the attention of the American Museum. The find was made by President C. E. Bunnell and his associates of the Alaska Agricultural College and School of Mines at Fairbanks, Alaska, and resulted from digging a posthole on the campus in the fall of 1933. In July, 1934, Mr. Jack Dorsch, one of Mr. Childs Frick's fossil collectors, now at the Museum, under Doctor Bunnell's direction dug a trench across the site and screened out about 400 mostly fragmentary artifacts, which reached Mr. Frick's paleontological laboratory last November. On examination by the writer, the collection proved to contain, besides hammerstones, chipped projectile points, and numerous reject flakes, about twenty small semi-conical flint cores and several small endscrappers. These last mentioned items, the cores and the small endscrappers, are of special interest because they are identical in several respects with thousands of specimens found in the Gobi desert by the Central Asiatic Expedition in 1925-28. The specimens furnish the first clear archaeological evidence we have of early migration to the American continent, apparently during the final or Azilian-Tardenoisian stage of the Paleolithic culture horizon, possibly 7000-10,000 B.C. — N. C. N.

Exhibition by American Museum Artists

The fourth annual exhibition of the work of the Staff Artists of the American Museum will open in the Maxwell Hall of Education April 22 and will continue until May 20.

Many members and visitors to the Museum scarcely realize the scope and variety of this somewhat unique art exhibition. One feature is the combination of scientific exactitude with the utmost in artistic appeal that can be achieved in any field of knowledge which the Museum covers; the other is the versatility of the individual artists in fields outside of the Museum's realm. Last year approximately five hundred examples of their work were shown — oil paintings, including portraiture, landscape, still life; sculpture; pen and ink, pencil and wash drawings; crayon, pastel; leather work, wood carving, pottery, glass blowing, artificial flowers, decorative tile, etc. The subject matter for this year promises a refreshing variation from the usual art exhibition.

The Britton Herbarium

The Britton Herbarium, just designated as the name of collections of reference material at the New York Botanical Garden, ranks as one of the world's most important collections of dried plants assembled for study. In the United States only the National Herbarium in Washington exceeds it in size, and even the flora of Asia is so well represented here that scientists come every year from across the Pacific to study the plants of their own country in New York.

The entire herbarium at the New York Botanical Garden now contains 1,774,687 specimens, of which 70,170 — the largest number in any one year of the institution's history — were mounted and added during 1934. The work of mounting was done by a corps of women, now long trained in this task, from the Emergency Relief Bureau.

More than a quarter million of the specimens are fungi, while 173,000 are mosses, 59,000 hepatics or liverworts, 77,000 algae, and 30,000 lichens. The enormous task of counting the herbarium sheets was completed by Emergency Relief workers last year. Accessions are now recorded each year so that from now on, there will be an accurate record of the size of the herbarium. Few institutions maintain such complete records.

But still more important is the convenient system of reference which is being installed — a system which saves many hours of work each day for the scientists and students using the herbarium.

Nowhere else in the world, so far as known, is such a system in effect.

The Record Proboscidean Tusk

In the January number of NATURAL HISTORY, page 84, are given preliminary estimates of the size and weight of the giant tusk of *Archidiskodon imperator*, presented to the American Museum by a life member, Mr. George D. Doughty, of Post, Texas. As these matters of record size are of great interest to naturalists throughout the world, we may give

the comparative figures of more recent estimates by Curator Harold E. Anthony and by Vice-Director James L. Clark:

	Circumference	Length	Weight (est.)
Record live tusk, African elephant, South Kensington, (Rowland Ward) . . .	24½"	10' 2½"	226½ lbs.
Record fossil Tusk of <i>Archidiskodon imperator</i> (Estimate of James L. Clark) . .	25"	15' 4"	339¾ lbs.
(Estimate of Harold E. Anthony)	25½"	15' 4"	400 lbs.

Doctor Clark writes: "You will see that the circumferences are approximately the same [the South Kensington and *A. imperator* specimen] and that the length of the fossil tusk is approximately fifty per cent over that of the live record tusk. Therefore, if we add fifty per cent to the weight of the record tusk, which is 226½, we arrive at a figure of 339¾ for the fossil tusk."

Doctor Anthony writes: "The fossil tusk is an inch and a quarter greater in circumference [than the South Kensington specimen] . . . We have left on the fossil tusk, then, a section at the base 5' 1½" long, or a piece about half the length of the piece we have just estimated. This butt section [within the maxilla] certainly would weigh more than half of this estimated piece, because it is approximately 25" in circumference throughout its entire extent. I imagine it might weigh at least two-thirds as much as the estimated section, or 160 pounds in round figures. The combined weight of the two sections would be 400 pounds, say. I consider that this is a conservative estimate and perhaps another 25 or 50 pounds might be added for good measure."

This giant tusk is being made the basis of a new reconstruction of the *Archidiskodon imperator* of Texas by Margret Flinsch which will give a shoulder height of 13 feet, 6 inches as compared with the maximum height at the shoulder of the African elephant of 11 feet, 6½ inches.

Distinguished Guests

After completing work in the laboratory of Sir Grafton Elliot Smith, Mr. George Pinkley, James Arthur Research Assistant, accompanied by Mrs. Pinkley, sailed for Hong Kong on the twenty-sixth of January. While in Hong Kong, Mr. Pinkley will continue his investigations on the relation between skull-form and brain-form, in the laboratory of Prof. Joseph L. Shellshear of the Medical School of the University of Hong Kong.

Recent American Museum Publications

AMERICAN MUSEUM NOVIATIES

- No. 776. African Muscidae. II. By C. H. Curran.
 No. 777. *Baridopplata*, a New Genus of Ostracoda, with two New Species. By H. N. Coryell, C. H. Sample and P. H. Jennings.
 No. 778. A Photograph and Description of *Masturus lanceolatus* taken at Tahiti, May, 1930. The Sixteenth Adult Specimen on Record. By E. W. Gudger.
 No. 779. Some Sponges of Lower California (Mexico). By M. W. de Laubenfels.

- No. 780. Notes on South American Mammalia. No. 1. *Sciurillus*. By H. E. Anthony and G. H. H. Tate.
No. 781. Two New Species of *Gymnotus*. By F. R. LaMonte.
No. 782. A Note on the Cynodont, *Gleichenodontoides gracilis* Haughton. By Lieuwé D. Boonstra.
No. 783. Bees of the Genus *Megachile* from the Belgian Congo. By T. D. A. Cockerell.

Recently Elected Members of the American Museum

Since the last issue of NATURAL HISTORY, the following persons have been elected members of the American Museum:

Associate Members

MESDADES ANNA H. AHRENS, GENIEVIEVE BEIR ALLEY, LISA ALLEN, GRÜTHCHEN FINCH BAYLE, FANNIE BROWDY, HELEN M. CUMMING, CHARLES O. FIERTZ, F. W. FREEMAN, MIRIAM FRIFOMAN, EFFIE MEAD GORDON, FRANCIS A. GRUBB, JOHN D. HANEY, ANNA S. HARKAVY, SAMUEL M. JARVIS, FREDERICK A. KOBEL, E. L. KUNKLE, JOHN LINDSEY, ROBERT LYVINGTON, LOUISE MACHER LONG, ETHEL R. LOTT, HENRY L. MISCHKE, C. M. NEALE, RICHARD H. PEARCE, ALICE SPENCER RICE, FLORENCE F. RICKERS, CAMDEN C. ROWE, SOPHIA S. SMITH, ARTHUR L. STONE, HENRY B. TWOMBLY, FRED WELLS. Misses LOUISE ALLYN, DOBIS LALLA BAKER, SARAH BERNHARD, ADELE BIRNBAUM, ALICE B. BOBBROW, HARRIETTE BRITTON, BROOGE F. BUCKLEY, GEORGE LLA W. BURE, CHARLOTTE A. CARVER, EVELYN CONNOLLY, ELIZABETH CULVER, REEA CURTIS, HELEN CUSTER, VIOLA M. DAKE, ETHELYN DAY, LENA LAWRENCE DAY, SARA E. DRESSER, JEANNE DREYFUS, PHEDE L. DUHOIS, MARY H. DRAPER, THERESA M. EBNETH, MYRTLE ECKHART, HILDA A. ERBECK, REBECCA ETTENDRER, MIRIAM I. EXINER, RUTH T. FITZELL, ROSE HAMBLOOM, FLORENCE S. HAMMOND, KATHRYN E. HARLACHER, LETITIA JANE HEMENWAY, CORA HILLYER, FRANCES I. HOCHBERG, ESTHER A. JACOBS, T. MARGARET JAMES, ANNA M. JOHNSON, REBA JOHNSON, IRENE B. KAHNEN, MARY G. KILVERT, WILHELMINA J. L. KLEER, CHRISTINA M. KOEHLER, MADELE E. KRONVALL, ADELE R. LEVY, M. M. LYNCH, MONICA T. MANSFIELD, MARY JANE MASON, ISABEL McDONALD, MADELINE MEEKER, FANNIE L. MOORE, MARY E. MOORE, ELIZABETH M. MORAN, MATILDA A. MORITZ, MARY MOUTAT, LAURA NALLIN, HAZEL B. NEER, EMILY NEWTON, MARGARETHE L. NIELSEN, ANNIE R. NUGENT, BECCA G. PARKY, JOSEPH N. PRIDMORE, MADELE E. PEARCE, CAROL LOUISE POTT, ETHEL POWERS, IRENE M. POWERS, CLARA A. PRIEST, EDNA R. PROVOST, DOROTHY L. RALPH, CELIA RAUCH, MARIOLG A. RILLY, CHRISTINA L. ROE, CHRISTINE E. RUPPERT, RUTH J. SCHLOCKOW, HAZEL D. SMITH, MARION H. STANWOOD, JOSEPHINE F. STAPLETON, HATTIE M. STRELITZ, ROSETTA NEWMAN TITTELL, ANNE ARRINGTON TYSON, SARAH F. C. YATES, ELSIE ZIMMERMAN.

Rescripts CHARLES C. FISHERBUR, JR., J. NUNAN, D.D.
Doctors JOHN HOWARD ACHESON, STANTON TICE ALLISON, J. BURNS AMBROSON, FRANCIS W. ANDERSON, JOHN T. ANDERSON, SOL AXELRAD, ROBERT H. BAKER, RALPH S. BANAY, RICHARD T. BANG, CURTIS J. BECKER, GEORGE L. BECKER, KENNETH L. BENFER, AXEL P. BERGMAN, ABRAHAM A. BERNHARDT, RICHARD BINION, ABRAHAM BLOCK, LOUIS BOHRE, FRANK BOSTOVE, WALTER E. BOSTWICK, PROSPER J. BOUDART, FREDERICK D. BRANCH, LESTER BREIDENBACH, HOWARD W. BROWN, GUSTAV BUCKLEY, WALTER IVES BUDINGTON, FRED R. BUECHE, RAYMOND BURNS, HECTOR DAVID CASTRO, GEORGE EDWARD CLARK, T. A. CLAY, MOSES COHEN, JULIUS H. COMROE, ANTHONY J. CONTY, GEORGE F. DALTON, A. F. DEWPEWOLFF, ALBERT J. DEVLIN, PAUL DOZIER, WARREN L. DUFFIELD, M. MILTON ECKERT, ADOLPH W. ECKSTEIN, JAMES H. ECKHART, FAY R. EMBELL, ANTHONY FAYORING, JACK FEIN, MORRIS FELLMAN, JOSEPH FELTON, NATHAN FIALKO, ISAIAH FRANK, FRANK HARRISON MCGREGOR, I. HAROLD FRANKLIN, LEOPOLD FREIBREGER, MEYER H. FREUND, E. D. FRIEDMAN, JOSEPH FUCHS, J. JAMES GANDERS, WILLIAM A. GARDNER, VAUGHAN C. GARNER, C. N. GELBER, WM. T. GODFREY, JAMES DOUGLAS GOLD, CHARLES GOLDFARB, CARL GOLDMAREK, J. BEN GOLDSTEIN, MARGARET A. SAMUEL S. NUSBAUM, ALFRED T. OGDON, BERNARD GREENBERG, HARRY M. GREENWALD, ELPHIDOE PHILLIPS HESSE, CHARLES H. HOLT, GEORGE A. HOFF, LEE W. HUCHES, DAVID JOE, J. THEODORE IRISH, LEO JACOB, SIGURD W. JOHNSON, WILLIAM H. JOHNSON, HARRY KAISER, ULYSSES S. KANN, JOSEPH KATZ, LOUISE E. KEASPEY, THOMAS BENJAMIN KEIN, ROBERT P. KNAPE, JOHN M. KOLD, M. KRIMKE, STUART E. KRIGAN, THAD A. KRODLIK, IRVING KROH, ARTHUR E. LAMB, MICHAEL G. LANDA, HARRY LANDSMAN, GEORGE LEVENE, HARRIS J. LEVINE, SETH A. LEWIS, HAROLD LIGGETT, JOSEPH E. LUMBARD, GEORGE EDWARD MAUREH, JOHN McALLISTER, H. STEWART McBURNEY, FLOYD W. McRAE, ROBERT A. MEE, H. VICTOR MENDELSSOHN, SAMUEL MONASH, ALBERT W. MOUTON, GERAHO H. MUELLER, J. ERNEST NADLER, G. L. NEUMANN, WILLIAM NEUMANN, JOHN L. NICHOLAS, JAMES NIGHTINGALE, SAMUEL S. NUSBAUM, ALFRED T. OGDON, SAMUEL M. PECK, ERNEST H. PIRKNER, HARRY S. PIZER, EMERY M. PORTER, NORMAN HENRY PRITCHARD, J. EDWIN PURDY, WM. A. RANDEL, PAUL ERNEST RAUSCHENBACH, S. B. REICH, LEON REZNIKOFF, MAURICE L. RIFFS, HOPE T. M. RITTER,

BULLETINS

Volume LXVII Article 9.—Catalogue of Mineral Pseudomorphs in The American Museum of Natural History. By Clifford Frondel.

Volume LXVII Article 3.—Rodents of the Genera *Rattus* and *Mus* from the Pacific Islands, Collected by the Whitney South Sea Expedition, with a Discussion of the Origin and Races of the Pacific Island Rat. By G. H. H. Tate.

WILLIAM T. ROBINSON, SILVIO AMADEO SARATINI, GEYRA SARKANY, JAMES R. SCOTT, F. L. SEYMOUR-JONES, GEORGE ROBERT SHAPIRO, PHILIP SHAPIRO, NATHANIEL SPIELKOPF, DAVID SLOANE, ALEXANDER L. SMITH, W. HENLEY SMITH, SIDNEY SORBIN, MORTIMER D. SPEISER, E. MYLES STANDISH, WALTER T. STENSON, JOHN G. STUENDORF, 3d, PHILIP JOHN TRENTZSCH, FREDERIC N. WILSON.
Honorable JULIAN W. MACK.

Messrs. PHIL H. AHRENS, CHARLES A. ALEXANDER, SAMUEL J. ALGRANTI, F. CURTIS ALLEN, WINTHROP ALLEN, THEO. R. ALPENFELS, W. G. ARNOT, ROBERT T. ASH, MAURICE ASHER, H. V. ATKINSON, FRANK L. BAILEY, GEORGE RAILY BAILEY, LAURANCE C. BAKER, WILLIAM PITY BALDWIN, L. S. BARKLEY, THOMAS E. BARNS, JOHN FOSTER BARR, JAMES BARROW, WILLIAM L. BARRETT, GEO. O. BENSON, JEFFERSON D. BILLMYER, HARRY TEMPLETON BIRNEY, R. C. BITTENBENDER, A. C. BLANCHARD, EDMUND T. BLAZEWICZ, LEOPOLD BLUM, FRANK BLUNTZER, GEORGE C. BOOHN, DAVID BORNET, GEORGE C. BEINER, J. D. BROTHIER, H. EMMETT BROWN, GEO. G. BULKLEY, RALPH W. BULL, J. E. BUTLER, JAMES H. COBERLY, HENRY COBY, SAMUEL E. COXE, FRANK L. CHADDS, ELMER E. DALEY, WILLIAM L. DAMBACH, CHARLES F. DAVIS, GEORGE H. DEHN, JR., NATHAN DE SCHEREE, E. L. DICKSON, WALTER H. DIERS, IRVING DOUGLANS, GEO. H. DOSCHER, A. F. DRUMMOND, ALBERT EARLEY, GILBERT D. EATON, ALBERT E. EBERMAN, ANDREW EDWARDS, JR., CHAS. O. EDWARDS, J. M. EDWARDS, ALBERT W. EICHENBERGER, ALFRED M. ELLINGER, RODNEY RAY ELLIS, WILLIAM A. ELLIS, ARTHUR C. ERNSTOESZER, WILLIAM CARSON ERLVIN, JAMES W. FAIRCHILD, JAMES FAIBET, LEO FELDMAN, W. T. FIERY, A. CARLTON FITNER, L. F. FLICK, J. W. FOSTER, HERMAN W. FRENCH, LEONARD D. FRESCUOL, CHARLES B. GARDINER, EDWARD MARTIN GATES, JAMES G. GÖBLISCH, HERBERT S. GOODMAN, SAMUEL J. GREENDROR, STANLEY E. GREGG, EDWARD BELLAMY GRESSER, MORRIS GUIN, E. H. HANKESSON, C. W. HANKE, ALFRED HARRIS, C. P. HASSE, W. ROWLAND HAWKINS, O. F. HENNINGS, H. G. HILLEN, ALBERT E. HOLLAND, DAVID B. HODGSON, H. H. HOOKER, WALLACE B. HOUSE, JOHN C. HOWARD, ELLSWORTH EUGENE HOWE, ROBERT W. HOWES, FRANK LEROY HUBBARD, CARL H. ILL, ROBERT JACKSON, WALTER JACOBSON, HENRY JACOBY, J. C. JEFFRIES, B. A. JOHNSON, HAROLD JOHNSON, CARL A. KANSKE, EDWARD LELAND KELLGOS, J. K. BELLGOS, O. R. KEHLEY, SIDNEY J. KEEZBERG, HOMER D. KLUMPF, ALFRED KINAZIEH, W. E. KOHN, SOLOMON KORAL, CHARLES A. KRAMER, EDWARD KRAMPFNER, JOHN A. KULEY, LOUIS KEVIN LAMBERT, FRANCIS LA FORTE, RALPH H. LARSON, J. WILBUR LEWIS, WM. J. LEWIS, HOWARD Y. LISSENDEN, H. W. LLOYD, R. L. LODGE, C. E. LOERTZ, R. A. LONGMAN, WILLIAM P. LOUGH, HOWE LUCAS, WILLIAM HOWARD LUNDIN, JOHN LUXTON, W. C. LYON, S. L. MAGIERFIELD, WILLIAM N. MALDIN, F. S. MALLEY, ABRAHAM MANDELSTAM, MILTON B. MARKS, JAMES C. MARTIN, JOSEPH MCADAM, BROOKS W. W. MCCLURE, H. L. N. MCCLURE, LESLIE G. McDONALD, ROWLAND R. McELVARE, FRANCIS J. MCGINNIS, JAMES H. MCGOWAN, G. P. MCGRAW, B. B. MCKAY, WHEELER MCMILLEN, E. G. MCMONIGLE, SAMUEL HERBERT McVITT, GEORGE P. MEADE, FREDERICK HENRY MEISNER, JOHN BUNKER MENONCA, HAROLD R. MERWARTH, JOHN M. MERWIN, HARRY O. METZGER, FREDERICK P. MEUSCH, JOHN L. MILHOLLAND, JR., FRANK G. MILLER, ALBERT E. MILLER, DAVID B. MILLER, EDWARD MILLER, CHARLES MITCHELL, RALPH E. MOOK, JOHN G. MOORE, THOMAS WM. MOORE, JR., WALTER D. MOORE, JR., BERT MORGAN, FREDERICK N. MORGAN, J. I. MORGAN, HARRY T. MORRIS, KENNETH M. MORRISON, JOHN A. MORSE, L. HOWARD MOSS, HENRY R. MULLER, BARRY S. MURPHY, D. M. MYERS, JACOB W. MYERS, ROBERT F. NELSON, C. N. NEWCOMB, HARVEY E. NEWCOMER, H. ARNOLD NEWCOMB, WILLIAM D. NIER, A. B. NOLAN, R. G. O'CONNOR, ROLAND M. ODGERS, JAMES E. O'KANE, REX L. OLIVER, FRANK L. PARK, LLOYD PENICK, JOS. J. PEYRON, L. H. PETIT, F. R. PHELPS, ARMSTRONG DAVID PHILLIPS, HENRY PICK, DAVID B. PLUM, LLOYD POLHARD, J. C. POOLE, W. E. POPHAM, ROBERT E. POWELL, J. H. POWERS, ROY EDWARD PUSHEE, HORTON F. RANDALL, CHARLES R. RASH, ROBERT L. RAYMOND, VICTOR P. DA COSTA, HIRSH A. J. REICH, E. V. RICHARDS, FRANK R. J. RICHTER, M. H. N. RITTER, JAMES ROBERTSON, ALBERT S. ROBINSON, NATHAN A. ROTHSTEIN, ROSOLINO L. ROTOLO, J. A. RUTHERMAN, H. G. SAFFORD, GARRET SANDERSON, JR., CARL G. SCHMIDT, ANDREW C. SCHNACK, JOHN SCHWAZ, V. BAYARD SNEEDER, SAM G. SMITH, G. H. STAHLER, J. H. STANLEY, H. H. STECHER, SIDNEY H. STEIN, FREDERICK STEWART, ABRAHAM STONER, H. M. STREETER, CHARLES F. STENZ, CHARLES H. TRAISER, PATRICK A. TWOMEY, JULIEN W. VOSE, HERBERT WALLER, GEORGE A. WAY, J. H. M. WEDDERBURN, CHRISTIAN N. WENGER, W. C. WILKINS, JACOB WILLIAMSON, ADOLPH F. WIZEMANN, EDW. R. ZIEGLER.

Reviews of New Books

Recent Publications for Those Interested in Nature

The Musical Instruments of the Native Races of South Africa. By Percival R. Kirby. Oxford University Press, London, Humphrey Milford, 1934. 285 pages, 73 plates (156 illustrations) and music. Published with the assistance of a grant made by the Carnegie Corporation through the Research Grant Board of South Africa. \$12.

IN ORDER to procure the material for this magnificent volume, Professor Kirby made nine expeditions covering thousands of miles and several years, into the interior of South Africa. It was his aim in assembling and publishing the data on the great wealth of native musical instruments in this part of the continent, to make the study as complete as possible. There is every indication that he succeeded, not only in procuring the information, but in his explicit, clear, and interesting descriptions, his musical examples, which give not only the tunes played but the manner in which they were produced, and the fine photographs, showing not only details of construction but the manner of manipulating the instruments. No expenditure of time or money has been spared on this volume, which, in its physical make-up is in the best Oxford style, and it will doubtless take its well-deserved place as the standard reference on this subject for all time. The author has arranged that separate sets of the photographic plates may be procured by museums, so that each may be placed beside the appropriate instrument on display, to illustrate its manner of use.

The reviewer has only two "unfulfilled wishes," the first being that in his complicated chapter on Stringed Instruments, with its sub-groups and numerous cross references to instruments and tribes, the author had clarified his treatment, which is straight running text, with a tabulation of sub-groups by number at the beginning of the chapter and a physical division of them by sub-headings as they were taken up in detail. Most of his readers will approach the subject as relative strangers, and be confused by the labyrinth in which Professor Kirby has long been so at home.

Second, while it is unfair to demand a treatment which the author obviously did not intend to go into, in a pure cataloguing and description of instruments, the addition of some maps of distribution of types would have been very valuable. They could be worked out with due regard to time sequence and it is hoped that at some future time this will be done.

Psychologists and students of culture change should find of interest many remarks made in passing, particularly those on pages 164, 246, and 257 to the effect that despite the physical imitation of foreign instruments now going on, "the fashioning of and performance upon indigenous instruments has remained practically uninfluenced by such imitations, which, untrammelled by taboos or ceremonial

restrictions, seem always to have stood apart"; and that when performing upon these or even strictly European models like jew's harps, mouth harmonicas, German concertinas, guitars and auto harps, most of which are easily capable of producing diatonic scales and full harmonies and readily played, the pagan native never performs European music on them, but only that designed according to his own principles, deliberately omitting other possibilities. This has even been noted in the borrowing of the idea of reed flute ensembles from the Venda by the Sotho and Ndebele, whose own scale was retained. Moreover, Christian natives, i.e., presumably those born and brought up in a Christian environment, are seldom seen with the types of instruments popular with the pagans.

— HELEN H. ROBERTS, Yale University

The James Johnstone Memorial Volume. Issued from the Lancashire Sea Fisheries Laboratory and published by the University Press of Liverpool, 1934.

THIS is indeed a fitting memorial, summarizing the life and activities of the famous "J. J.," as he was affectionately known to his colleagues. This volume begins with an excellent biographical note by F. J. Cole, professor of zoölogy in the University of Reading, England, and is amplified by reports on a series of original researches relating to marine and fresh-water biology, such a series as would be produced by a fisheries laboratory.

The late James Johnstone was one of the most famous of modern oceanographers, and was foremost among the authorities on fishery research in Europe. As such, he was a self-made scientist, starting out as a poor boy and practically forcing himself through all the preliminary stages of preparation. He was admitted to London University in 1897, and in South Kensington came under the influence of Professor Howes. Later, he succeeded Andrew Scott in the Fisheries Laboratory in Liverpool. He graduated as a Doctor of Science at London University in 1913. He was the author of some ninety papers and books, most of the former appearing in the annual reports of the Lancashire Fisheries Laboratory at Liverpool. In 1920, he was appointed professor of oceanography, and subsequently honorary director of the scientific work of the Lancashire Sea Fisheries Committee.

Among his most useful publications was the *Introduction to Oceanography*, in 1923, of which two editions were published, and his *Study of the Oceans* in 1926. A *Monograph of the Marine Plankton* followed in 1928, and his last work, a textbook, *Essentials of Biology*, was published in 1932, the year of his death.

Aside from his more special researches, he developed a world-wide reputation due to his insight into the principles and methods of oceanography. Naturally a philosopher, his many-sided mind caused him

to devote much time to the general problems of biology, and he wrote three books on the subject, namely, the *Philosophy of Biology*, in 1914, and the *Mechanism of Life*, in 1921, as well as the *Essentials of Biology* already mentioned. Space does not permit a discussion of his philosophical views. His organizing ability, his talent for practical matters in connection with fisheries problems, and the philosophic side of his investigations give a comprehensive idea of his versatility.

To give even a brief description of the score of papers brought together in the Memorial Volume to honor this great man would fill many columns. Suffice it to say that his scientific colleagues, friends, and associates joined in contributing from the best of their scientific work to honor his name and to emphasize by their own attainments the eminent circle of scientific thinkers to which he belonged.

— ROY WALDO MINER

The White Headed Eagle: John McLoughlin, Builder of an Empire. By Richard G. Montgomery, 358 pp., Macmillan Company, \$3.50.

THIS is a worthwhile account of the Hudson Bay Companies' conquest of the American "North-west." It is also the story of Chief Factor, Dr. John McLoughlin, who, as dictator of the Oregon and Vancouver territories during the first half of the Eighteen Hundreds, carved the foundations of Empire for Great Britain. Unwittingly "Doctor John" also pioneered for the future territorial expansion of the United States. After a rough life of persevering struggle and hardship in behalf of Canada, McLoughlin ended by becoming a citizen of the United States, spending his last days in the country of his adoption.

The book furnishes us with a condensed picture of the fur trade in the Columbia River region. It tells of heroic overland journeys, of the establishment of far flung trading posts, of colonization and of Indian warfare.

Doctor McLoughlin is presented as a slightly saint-like individual, who ruled with a firm but pious hand. At times it seems a pity that he was not possessed of more vices. One of the relieving scenes showing the Chief Factor in "a most unfavorable light," concerns a hypocritical and officious visiting minister whose activities were more related to politics than to religion. The minister persisted in writing untruthful and slanderous statements relative to the manner of "Doctor John's" conduct of affairs in Fort Vancouver. Doctor McLoughlin's ire was raised to the extent that, on one occasion, "up went his trusty cane" and he "inflicted several sound blows upon the shoulders of the impertinent Divine." One gathers that the stern Doctor had many difficulties with "Divines," for the author has entitled one of his chapters "Too Many Missionaries."

Of far more importance than Doctor McLoughlin's sterling character is the panorama of wilderness exploitation, set forth throughout the book. It was ever an instance of "gold lies where fur is." The wel-

fare of the country as a whole, and the well-being of the men who preyed upon it, was totally lost to view. Every other consideration was put aside until the fur-bearing animals had been reduced to a scant remnant of the original wild life population.

In the fifteen references to the slaughter and use of the all important beaver alone, we discover many revealing tales of trapping experiences and of sharp practices in trading with the Indians. As late as 1842 fur was the medium of all barter. We find a man in need of clothing, but without the necessary wherewithal to secure it. Mr. Montgomery tells us that "Money, had he possessed it, would have served no useful purpose, as furs, at a fixed valuation, constituted the first coin of the realm, and wheat the second."

A careful reading of this book, with frequent reference to the fine bibliography, should serve to provide a good popular approach to a further background study of the history of the states of Oregon and Washington. The work is well indexed and well written.

— W. H. CARR

Homes and Habits of Wild Animals. By Karl Peterson Schmidt. M.A. Donahue & Co.

Homes and Habits of Wild Animals is the title of an attractive book written by Karl Peterson Schmidt and published by M. A. Donahue & Co. Mr. Schmidt is the assistant curator of reptiles at the Field Museum of Natural History in Chicago, but has had extensive field experience and an opportunity to make many observations on the habits of mammals as well as reptiles. Although the book is written in terms simple enough for younger readers, and the presentation is that often followed for juvenile publications, readers of all ages will find these pages interesting and instructive.

Mr. Schmidt, who, many readers of *NATURAL HISTORY* will recall, was formerly on the staff of the American Museum, has selected his nine chapters to deal with animals, not in a blood relationship, but as animal workers, animal fishermen, animal travelers, et cetera. In these chapters he selects outstanding examples as illustrations, and in a simple, descriptive style holds up the characters for inspection. A liberal use of narrative and anecdote brightens the picture.

The work is illustrated by Walter Alois Weber, with twelve full-page color plates and numerous marginal drawings. Mr. Weber displays a close acquaintance with mammal psychology, and his figures have character and action to a remarkable degree. The only criticism one might make is with regard to the somewhat high coloring of the full-page plates. The tendency of the artist to see purples in the shadows results in a rather high key for these plates. The result is, however, a very pleasing and brilliant picture without any very great violence to fidelity. Furthermore, children will react very favorably to this type of colored illustration.

— H. E. ANTHONY

NATURAL HISTORY

The Journal of the American Museum of Natural History

VOLUME XXXV



MAY 1935

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Manuscripts should be sent to the Editor, The American Museum of Natural History, New York, N. Y.

SUBSCRIPTIONS: NATURAL HISTORY is sent to all members of the American Museum as one of the

privileges of membership.

ADVERTISING: Tom Davin, Manager of Publications, The American Museum of Natural History.

PUBLICATION OFFICE: 10 Ferry Street, Concord, N. H.

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Photo by A. L. Schusler—Courtesy of Park Dept.

WILD LIFE IN A CITY PARK

For the urban populace who never see wild creatures in their natural state, zoölogical gardens provide a valuable educational medium.

With modern methods of construction and management, even miniature zoos are able to exhibit a wide variety of interesting types

A Modern Picture Book Zoo

The reconstructed zoölogical garden in the heart of the great New York Metropolis

THE new miniature Zoo in Central Park, New York City, might well be followed as a model by many small cities unable to afford an extensive and expensive collection of animals.

Its compact design allows more than one thousand animals and birds to be exhibited comfortably in less than seven acres of park area such as most small cities possess within walking distance or trolley range of every citizen. Leaving scientific research to the larger institutions, this zoo aims primarily to instruct and amuse the people. That it succeeds is testified by the fact that it is the most popular spot in all the numerous park areas of Manhattan.

It has been called the "Picture Book" Zoo, because it exhibits all the primary types of animals such as are usually illustrated in a child's picture book. In a section which ordinarily would be devoted exclusively to lions, for instance, the Picture Book Zoo, instead of displaying a score of identical animals, shows ten or twenty different species of creatures. The Picture Book Zoo does not appeal solely to children, however, for according to Director of Menageries, R. Cheyne Stout, approximately 80 per cent of the visitors are adults.

One large harmonious family

One is impressed in walking among the clean, well-ventilated cages by the fact that the diverse collection is as harmonious as one large family. Every animal possesses a personal name of its own, and frequently responds to it. All of the lions and tigers, for

instance, will come when called, and will allow their keepers to pat them or will even lie down to have their chests scratched.

Talented inhabitants of the Zoo

There is scarcely an animal in the collection which does not perform some little trick at the behest of a particular attendant. "Ink," a spider monkey of South American extraction, is always glad to shake hands with anyone who wishes to meet him personally, but needless to say he does not shake hands with all of the 72,000 that have been known to visit the Zoo in a single day. Jiggs and Anna, chimpanzees, like occasionally to be dressed up like human beings, and they appeared to enjoy the Christmas tree that was prepared for them as thoroughly as did the visitors who watched them play with the toys they received.

Capt. Cheyne Stout hopes that he may be able to have a special training cage, where demonstrations can be made to show the intelligence of the various animals. It is also his hope that other zoos similar to the Central Park Zoo may grow up about the country with the same facilities, so that variety may be maintained throughout by the exchange of trained units.

Of the thirty-five or forty men who comprise the working force of the Zoo, only the ten keepers and their four assistants are permitted to handle the animals. Thus they attempt to understand the psychology of each creature, its whims and prejudices, so as to avoid discontent.

A portable ultra violet ray outfit enables

all the animals to receive the treatment regularly. Some of them "bask" under the actinic rays as often as once a day. The floors of all the cages are steam heated and constructed so that they may be easily cleansed by a flow of warm water. The washing of the floors occurs as often as half a dozen times a day.

The Culinary Equipment

The animals' diet kitchen is the last word in culinary design. There are two refrigerator rooms, one for meats and the other for vegetables. The chopping and grinding of food is done by electricity, with equipment that will accomplish anything from preparing French fried potatoes to grating nutmeg. Thus the dietary idiosyncracies of the animals can be taken seriously into account. All the cooking utensils are of heavy aluminum.

The veterinarian visits the Zoo every day, and there is daily inspection of all animals. For the smaller mammals, a special operating room is equipped with miniature operating table, illuminated by flood lights installed within the ceiling. The dispensary contains about \$1000 worth of medicines.

Most of the animals of the Central Park Zoo have been acquired by donation. In addition, breeding in special enclosures provides surplus animals which are traded for new species from other institutions. Transactions of this sort are of course limited, however, by the general rarity of zoos throughout the country.

Only perfect specimens are accepted. The animal donated must be young, active, and

healthy, and is admitted to the cages only after undergoing a period of observation in quarantine. The result is a conspicuously healthy collection of animals exhibiting a remarkable degree of animation and good temper.

The designers of the Zoo in their consideration for the welfare of the animals have by no means neglected the comfort of the spectators. One can dine in the spacious restaurant overlooking the glistening concrete pool where the seals are continually disporting themselves amidst the splashing fountains. The tasteful layout of lawns and hedges adds to the restfulness of the setting. And the animal houses are well ventilated and lighted.

A real backer of the Central Park Zoo has always been Alfred E. Smith. It was in recognition of his interest, therefore, that at the opening he was appointed Honorary Night Superintendent of the Zoo. He passes an average of three evenings a week there, and in the opinion of the caretakers, all of whom he knows by name, he performs the duties of a superintendent excellently.

Maintenance Costs

Zoos are not expensive to operate, Captain Stout asserts, if the buildings are modern and easily cleaned, if the force is experienced, and if the cages can be filled with fine, virile stock. The compact Central Park Zoo could be duplicated, he believes, at a cost which should not be beyond the facilities of many cities of approximately 100,000 population and upward. And once constructed, such an institution should be self-supporting.

SIX performing monkeys and a Tibetan sun bear have just been donated to the Central Park Zoo. These are the gift of Mr. and Mrs. Felix de Marce, exhibitors of animals, whose troupe they comprised. The de Marces are retiring from professional life and have chosen the Central Park Zoo as a pleasant home for their pets.

Katie, the Tibetan sun bear, rides a bicycle, it is said; whereas Booby, a Chachma baboon, prefers a motorcycle. Polidor, a bonnet monkey, distinguishes himself by imitating Charlie Chaplin, while Whiskey, one of two large rhesus monkeys, specializes in tight-rope walking. Others in the troupe are a long-arm baboon and a ring-tail monkey.

Shortly after their animal friends were lodged in the Zoo, Mr. and Mrs. de Marce made a call upon them to make certain that they were happy.

Mystery Island of the Pacific

*An account of an extraordinary island and its strange civilization,
visited recently by the Crocker Pacific Expedition*

By H. L. SHAPIRO

*Associate Curator of Physical Anthropology,
American Museum*

EASTER ISLAND, except to the Easter Islanders themselves, either means nothing at all, or it calls up a trinity of associations.

It is one of the most isolated spots on the globe, it contains a large number of huge monolithic statues, and it once had, until removed by travelers, a series of wooden tablets covered with an undeciphered script. These three phenomena and the speculation concerning them inspire the automatic appellation of "mysterious" whenever Easter Island is mentioned. And curiously enough that adjective does, in brief, explain the special interest that this island has for science as well as for the general reader.

Easter Island is usually regarded as having been discovered by a Dutch navigator, Roggewein by name, who sighted it on Easter Day in 1722. The claim is sometimes entered, however, that in 1686 the English buccaner, John Davis, while cruising the South Pacific in the ship "Bachelor's Delight," was the first to sight it. The fact remains, nevertheless, that Davis' description does not fit Easter Island. Nor can Roggewein be said to have furnished us a completely reliable report. He described woods and forests where his successors have found none, and he mentioned seeing giants whom no other has ever discovered. The exact number of inhabitants in Easter Island at this period is rather vague. Roggewein casually mentions that "many thousand of these islanders came thither; some brought us fowls, with plenty of roots, others remained on shore, running to and fro, from one place to another, like wild beasts."

In 1770 Easter Island was visited again, this time by a Spanish expedition. Four years later that superb navigator, Cook, whose nautical skill was fittingly complemented by his perceptive abilities, landed on

the island. From his account and from La Perouse, an equally famous Frenchman visiting Easter Island twelve years later, we obtain the first reliable impression of the character of the island and of the wonders it contained. They found it a grass-covered island lacking both wood and water, but rich in huge statues and elevated stone platforms.

The natives who greeted them were scantily garbed. For the majority, a meager fringe attached to the front of a narrow belt sufficed as a garment. Some few, however, wore in addition a shawl made of tapa, dyed yellow. Head coverings were constructed of bird feathers set into a circular band. Equally simple were the weapons displayed: spears tipped with flaked obsidian points and wooden clubs like those used in New Zealand. As in other Polynesian islands tattooing was extensively employed as an adornment, and elaborate designs covered face and body. The women painted their faces as well. It was observed that most of the islanders had perforated and extended the lobes of their ears to a prodigious size. A spiral of cane leaf was worn to keep the lobe at its maximum distension. Indeed, the entire life of the people appeared to be on a very simple plane as regards the materials of everyday life. And yet it astonished these visitors to see the exquisite refinement of their carving of small figures in wood.

It was observed that the islanders of both sexes would as soon swim out to greet their visitors as paddle in a canoe. The canoes, although not numerous, were extremely interesting. Small and degenerate in comparison with the elaborate double canoes of Tahiti, the Easter Island canoe was the product of necessity. The absence of timber on the island forced the natives to utilize every piece of drift wood washed ashore. From these miscellaneous fragments of wood, fitted together like a jig-saw puzzle, their canoes were constructed.

Cook took the population to be 600 to 700 in number. Forster, who accompanied Cook,

reckoned it to be 900. La Perouse, however, estimated 2000. This discrepancy may be laid to the fact that Cook saw very few of the native women whom he supposed to be kept in hiding during his visit. In 1825 Beechey guessed the population to be 1500.

The list of succeeding visitors is not large. Easter has ever remained outside the common channels of oceanic travel and commerce, and it has had little of commercial value to attract intrepid navigators to seek its shores. In 1862, however, certain Peruvians decided that Easter Island very decidedly did offer a field of exploitation. A raiding party was organized and it descended on the defenseless island, carrying away practically all of the inhabitants to work in Peruvian guano fields. The alarming death rate among the islanders, following their transplantation, and the humanitarian protest of the French minister at Lima finally persuaded the Peruvian government to restore them to their island. Unfortunately, the restitution came too late, and a mere handful of survivors were set down on their native heath. Imported diseases among these people, lacking in acquired resistance, continued to reduce their numbers.

Later history of Easter Island

About this time (1864) a Catholic missionary from Chile visited the island and established a body of communicants. Catholicism has ever since remained the professed religion of the island, although no duly appointed cleric is at present resident.

In 1867 a Frenchman, Bornier, arrived from Tahiti, and, financed by Brander, a merchant at Papeete, acquired large tracts of land for sheep and cattle raising. Somewhat later, Salmon, also from Tahiti, took up extensive holdings. It is said that at this period the population had been diminished to 175. In 1888 Chile formally claimed possession of the island, and since no European power saw any advantage to be gained in acquiring it, it was permitted to remain under theegis of Chile. Finally in 1897 the Brander-Salmon property, which included practically all of the island, was transferred to Mr. Merlet of Valparaiso and eventually to Williamson-Balfour Company of the same city. This company runs about 40,000 sheep and has an annual clip of about 61,000 kilos. The station is under the charge of a foreign manager who

employs about twenty or thirty natives as herders and workmen. Once a year a chartered vessel calls to remove the wool clip. Aside from this visit there are no regular boats of call, although unscheduled ships do stop occasionally.

The objects of our visit to Easter were to make a racial study of the pure-blooded Easter Islanders, to collect ancient crania and skeletons, and to cast a typical stone statue for reproduction at the American Museum. The successful issue of these projects was made possible by the generosity of Mr. Templeton Crocker, who organized the Templeton Crocker Expedition and led the party in the field.

The expedition arrives

For days, the yacht "Zaca," bearing the expedition, rode the long, unbroken swells of the South Pacific, plowed through mile after mile of vast, desolate seas, saw the Pacific change from a silken calm of violet and brown to a sullen, tortured mass of purple and white. And, finally, two weeks after bidding the Pitcairn Islanders farewell, when we had almost come to believe that the existence of Easter Island was, after all, a myth, we saw its gray silhouette on the horizon. It was magical. Moreover, it clinched in our minds the knowledge that Easter Island *is* remote—a lonely fragment of land, 2600 miles west of Valparaiso, 2750 miles southeast of Tahiti and 1400 miles from Pitcairn, the nearest inhabited spot.

We sighted Easter in the early afternoon of January 13 of this year, and until we anchored off Hanga Roa at about 7 P.M. we spent most of our time watching the low-lying gray cloud gradually focus into a wheaten-colored treeless plain, dotted with volcanic cones. Except for a brush stroke of heavy green around the village, the prospect was more than desolate in appearance, and the disappointment of Cook on seeing this dry, brown island after a hundred days at sea could well be imagined.

We had no sooner dropped anchor than we saw a smart-looking boat put off from shore with an officer in command. The men were in uniform and displayed a true naval style. Our visitor was the Chilean administrator who was followed by a boat load of islanders. My interest in these visitors was naturally very intense. Their clothing consisted of

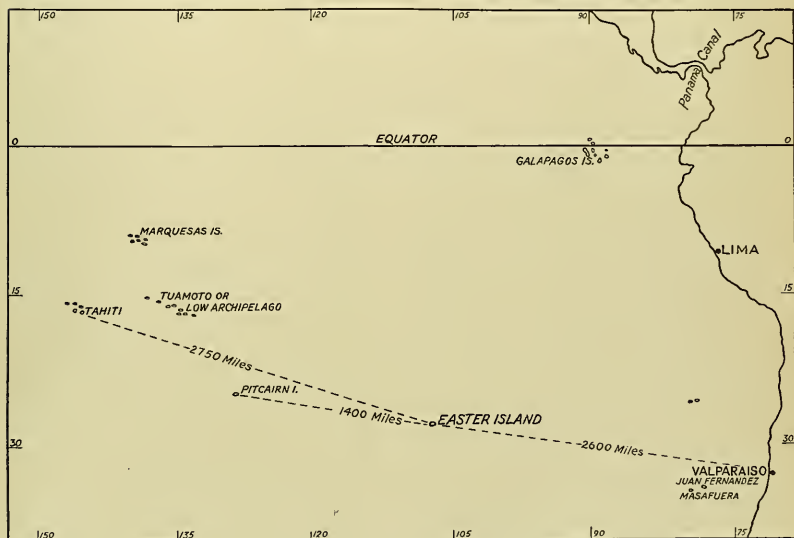
cast-off odds and ends of naval uniforms. As they pushed forward eagerly with their curios, roughly cut stone and wooden figures, I could examine them more closely. I saw what I had anticipated. They were a mélange of Polynesian and every variety of European. But here and there a face gave me hope that perhaps the unadulterated strain of Easter Island had not yet completely disappeared. Discouraged, at last, by our reluctance to relieve them of their inferior carvings, they finally left but not without casting appreciative eyes over the graceful lines of the "Zaca."

There are now living on the island about 440 natives. Most of these are the descendants of the 175 survivors in 1871. A few Tahitians have settled here and intermarried, several Europeans have resided on the island for varying periods, and passing ships have provided still another source of miscegenation. But from among this mixed population, we were able, by careful checking, to segregate a small number of individuals whose blood had been uncontaminated by foreign admixture. This series of Easter Islanders revealed a type which, although Polynesian, neverthe-

less departed from it sufficiently to merit a sub-classification of its own.

The origin of the Easter Islanders presents a vexing problem to anthropologists. The reasons for this are several. Although linguistically and culturally the Easter Islanders have very close affinities with Polynesia, there does exist a number of non-Polynesian elements in the Easter Island complex. Moreover, the position of the island as the farthest extension of Polynesia toward the American mainland has encouraged some students to see it as a stepping-stone in a cultural causeway between Oceania and America. Mrs. Routledge, inspired by Balfour's comparative study of the bird motif in the art of Easter Island with similar figures from the Solomon Islands in Melanesia, has argued that a Melanesian migration reached Easter and mixed with one from Polynesia. This opinion is further supported by her interpretation of native traditions and by studies made on the ancient crania. Melanesian characters are said to exist in these skulls.

On this last point my own investigations are as yet too incompletely analyzed to be



ISLANDS OF THE PACIFIC OCEAN

The geographical isolation of Easter Island is manifest from the above map. Moreover, the island is outside the

lanes of Trans-Pacific travel. Once a year a chartered vessel calls to remove the wool clips

brought forth in support or in rebuttal. But from a preliminary survey, it seems probable that neither the results of blood groupings nor of anthropometric examinations will confirm the belief in a Melanesian strain. The blood groups are proportioned as in the rest of eastern Polynesia and no evidence of the frizzly hair or the flaring noses of the Melanesians was found.

As for the possibility of Easter Island as a connecting link between the Old World and the New, it is wiser to await a more complete demonstration. Needless to say the appetite for speculation far exceeds the food supplied. A discussion along this line would lead into much greater space than I have at my disposal and would involve hypothetical judgments on currents and wind effects.

The mere presence of man on this detached chip of land symbolizes better than anything else could do the nautical genius of the Polynesian. The courage which inspired the launching of slender, frail canoes into unknown seas, the hardihood which supported the men and their women during the long, hopeless weeks or even months out of sight of land, are heroic and give one an illuminating insight into the method of colonization in far-flung Polynesia. And more than this, it recalls the numerous tragic voyages which one successful landfall represents.

The ninepins of Rano Raraku

The second of Easter Island's threefold aspect likewise makes a vivid appeal to the imagination. The uneven lines of statues on the inner and outer slopes of Rano Raraku enhance the impression of mystery attached to the island. Lying face up or down, partly buried and standing erect, these monoliths, some as high as 30 or 40 feet, are tangible evidence of a once powerful social force. The questions which spring to the mind of the casual observer are the same as those which puzzle the expert and, in both cases, remain unanswered. How were they erected, these blocks weighing tons? How were they moved, frequently fifteen miles, and then set up on stone platforms? What was their significance? The guesses that have been made vary in plausibility. Some are purely imaginative, unfounded and improbable; others, more worthy of consideration, are the results of patient study by devoted students.

Below the quarries on the uppermost tiers of the inner and outer slopes of Rano Raraku are these Gargantuan figures, facing away from the beds from which they arose. Mrs. Routledge has denied that these statues which clutter the hillside were ever intended as a reserve stock from which suitable ones might be selected to be set up elsewhere. And the fallen and fractured images which define the ancient roads from Raraku have also been explained, not as abandoned in transit but as permanent monuments lining the road. The fact remains, however, that at various points on the coast stone platforms still exist with broken images at their bases. When Roggewein visited Easter Island these figures were standing in place. Later visitors found some fallen. Now, not one is upright.

Easter Island once a continent?

It has been postulated that a huge population was necessary to account for the manufacture and transportation of these goliaths in stone. La Perouse minimizes the difficulty by saying that a couple of levers and rollers were ample to move them. But levers and rollers of what in a treeless island? Some of the explanations are fantastic. Among those which have been offered are an overhead aerial railway and lubrication by grass and seaweed. It has also been suggested that the present island is the remainder of a once more extensive land now engulfed by the sea, following a cataclysm of some kind. This former, more extensive island, or even archipelago, it is added, had a much greater population — 10,000 or more — which might easily, by means of rope lines and great forces of men, move these images. Several arguments might be used against this hypothesis. It is not geologically proven that any cataclysm has affected Easter within the period of its human occupation. In fact the distribution of all its monuments are against such a belief. The image platforms for the most part follow the present coast line, which argues for its unchanging character. Finally, moving the images in the manner suggested, would result in breaking them, since they are carved from a friable and loosely cemented stone.

Even the purpose of these images is not clear. It is generally supposed that they were commemorative of chiefs or kings and erected after their death. Neither Cook nor La Perouse noticed any special worship paid

them beyond a reluctance to walk within the limits of the platform. It has been pointed out that despite their unique character, they do bear a certain generalized similarity to the sacred images, or *tikis*, on other Polynesian islands. The Marquesan tiki, although of wood, had a platform support and was crowned with a red painted top like the red tufa hat surmounting the Easter Island images.

Casting an image

Even before we saw the sculptured monoliths on the flanks of Rano Raraku, we knew that with our equipment it would be impossible to bring back to the Museum one of those extraordinary relics. The next best thing appeared to be a cast. But the difficulty apparently was lack of water. All the accounts which we had diligently examined at sea made much of the absence of suitable water, and without that a cast was out of the question. We discovered, however, on reaching Easter Island that the extinct crater of Rano Raraku contained a lake from which water might be obtained with ease. The next step was the selection of a statue. It was necessary to settle on one that was typical and at the same time complete and in a position adjusted for the needs of casting. Those on the outer slope were not only too far removed from the source of water, but were too large. Even if we had the facilities for casting these 30- and 40-foot figures, their reproduction might prove embarrassing at the Museum. The choice, therefore, narrowed down to the statues on the inner slope. These were of a more manageable size and were close to the edge of the lake. The statue finally chosen was about 10 feet high and had the conventional characteristics of these monolithic figures.

Under a broiling sun and surrounded by a cloud of insects, Mr. Toshio Aseida labored for days taking molds of the figure. The cast was made in sections, each carefully numbered, and will be eventually displayed in the Museum.

Besides these relics of a former civilization, Easter has other archeological vestiges. Stone cairns, burial platforms, enclosures and walls of various sorts dot the island. Constructed of the ubiquitous volcanic rock, fragments of which lie scattered over the land like a rash, they constitute the most numerous of the ancient monuments.

Ancient house foundations are found in great numbers in certain parts of the island. These are long ellipses, averaging about 50 feet in length and 6 feet at their widest. The largest is 120 feet by 12. Neatly dressed stone blocks, accurately fitted to the lenticular curves, define the former walls. Each block had one or two holes on its upper surface. From the accounts of early voyagers, we know that into these holes were let poles which were then joined to form an arched framework over which thatch was spread. The entrance to these inverted canoe-like houses was very small. La Perouse says that these dwellings were bare of furniture, the floor was covered with grass and mats, and that they were apparently used only for protection against the elements.

Another type of structure has also been reported. This is a kind of stone tower. Its use as a watch tower has been suggested by Mrs. Routledge, but Skottsberg is inclined to consider it impractical for that function.

The stone village

But the most extraordinary collection of remains are the stone houses in the village on Rano Kao. These are connected with the peculiar bird egg ceremony and are located on the southeast ridge overlooking the crater of Rano Kao on the one side and the rocky islets off the coast on the other. Built of laminæ of rock, the wide, flat stones are neatly piled into walls, the upper tiers of which overstep and converge to form a corbelled arch. Long and narrow like the "canoe" houses, they were, however, much more pretentious. The inner walls were often lined by upright slabs, some of which were painted with symbolic and conventionalized designs. The entrance is a narrow tunnel from 4 to 6 feet long, and requires a prone position and considerable squirming to make the passage into the interior of the house which usually consists of only one room, on the average about 20 feet by 5 feet. One we explored had another chamber to the rear. Damp, earthy, and devoid of any light, this adjunct cell was distinctly unpleasant. It is inconceivable to suppose that these dwellings provided anything more than a protection, certainly no one would choose to remain within. Although many of these houses have been partly destroyed by visitors, enough remains to show their original character.

Once a year, when the sea birds arrived at the breeding season, the islanders gathered at this village. From the sheer cliffs overlooking the tiny, rocky, bird islands, various contestants would swim to the islets, and the first to return with an egg was proclaimed king for a year. Perhaps commemorating the ceremony, "bird men" are cut in low relief on a multitude of rocks in the vicinity.

During the period of encampment in the stone village of Rano Kao, waiting for the supreme moment of the egg race, the residents passed their time in dancing and feasting. The latter activity involved, on occasions, the rite of cannibalism. The human victims were consumed in a cave in the sea cliff near the village.

Egg races

Although the egg race was competitive, it was confined to certain people. Only members of the *Ao*, or ruling, clan were admitted and these were especially designated by supernatural means. A prophet might dream that a certain individual was in divine favor, thus bestowing on the favored one the right to enter the lists. The winner not only became sacrosanct but he also adopted a new name which was given to the year of his victory.

Usually the competitors were men of some importance. They ordinarily selected servants who entered the race in their behalf. While their principals were living in the stone village, these representatives dwelt in a cave on the islet awaiting the arrival of the birds, the first egg of which was so eagerly sought. Mrs. Routledge states that it was the manutara, or sooty tern, that furnished the sacred egg of this rite.

The detailed description of every point of interest in connection with Easter Island might easily require volumes. Mrs. Routledge has filled one fat book and she has not

exhausted the possibilities. I cannot, however, close this very brief and incomplete sketch of Easter Island without a final mention of the strange script once found there.

The curious can see the original tablets at only a few museums in the world. They consist of lines of hieroglyphic-like outline figures arranged in rows. To save the precious incisions from rubbing, an ingenious method was adopted. The wooden tablet was very slightly grooved, and the hieroglyphs were incised in these grooves, the ridges between the grooves thus preventing contact with the face of the script. Although a number of reputed translations of the tablets have been offered, no one has ever been authenticated, and the script has remained undeciphered.

It has been reasonably suggested that these tablets were in the nature of mnemonics. Thomson relates that he exposed one old native's claim to be able to read the tablets by secretly replacing the photograph of another tablet for the one the native thought he was reading without the substitution being detected. Nor could Thomson's translator decipher a character when taken from its context. Thomson suggests plausibly that the story of each tablet might have been memorized and that a recitation of this tradition had replaced an actual reading of the characters.

Recently, the characters found on seals in the ruins of Mohenjodaro in the Indus Valley and dating to the third millennium B.C. have been compared with these Easter Island characters, and a strong resemblance between certain ones is evident. It is too early as yet to accept unquestioningly this preliminary comparison. But should it prove incontestable, it will provide another connecting link between Polynesia and India, an association which has already been suggested by other evidence.



MONUMENTS OF THE PAST

The handiwork of Easter Islanders of centuries past survives in these monstrous statues. The economy in the use of planes is noteworthy, and, contrary to the opinion of

early visitors, represents a high degree of skill. The illusion of reality is heightened by distance. A cast of one of these figures was made for the American Museum



A VIEW OF EASTER ISLAND



The above panorama of the island was taken from the south and shows its flat, plainlike character, relieved by extinct volcanic cones like ant hills. The cliffs on the left contain the crater of Rano Kao and the ancient stone village where the annual bird-egg ceremony was celebrated



The typical islander has a very narrow and long head as well as a narrow face





AND SOME INHABITANTS

The population of Easter now contains about 440 persons most of whom are mixed with Europeans. The men on this page are reputed to be pure-blooded Easter Islanders. They resemble to some extent their relatives, the Polynesians, but they form a sub-group with special characters of its own

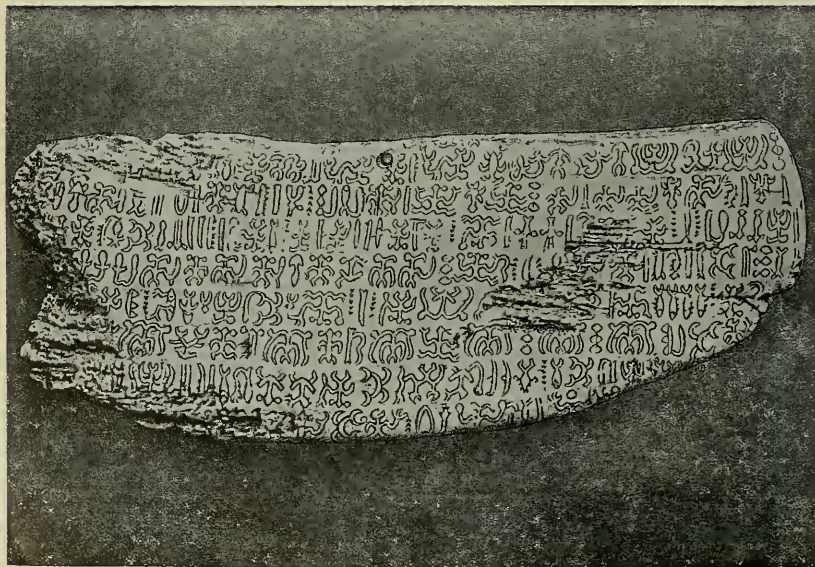


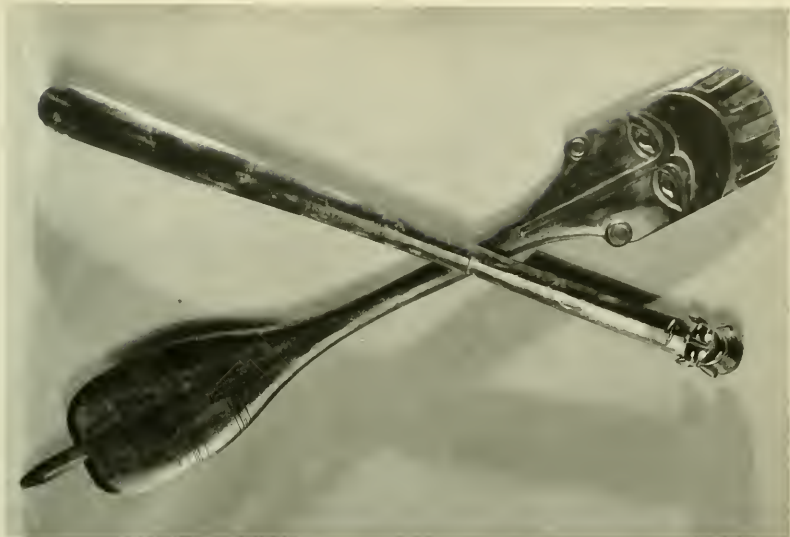
The man on the left represents a Caucasian-like element common in eastern Polynesia





The objects on this and the following page are in the collection of the American Museum of Natural History and illustrate part of the material culture of Easter Island. The wood-carving skill of the Easter Islanders is well illustrated by the figure in the upper left hand corner and by the "bird man" in the lower right of the next page. Stylism is frankly employed in these objects





The basket shown at the top of the opposite page is made of rushes, and is unlike those employed in other Polynesian islands. Below on the opposite page is a cast of a wooden tablet covered with the undeciphered script, formerly read by the natives. The picture on the upper half of this page shows a ceremonial dance paddle and a club. The heads on both are Janus-like. Directly below is a rare stone fishhook





The above photograph represents an image platform upon which statues similar to those pictured on the facing page were set. The images which formerly occupied these platforms were huge circular hats of red tufa. Below are a group of carvings, representing "bird men," on the rocks near the stone village on Rano Kao





The slopes of Rano Raroku are dotted with images like those shown above, whose immutable and pouting expressions lend an air of strangeness to the scene. Many, however, have fallen and are in various stages of exposure. The one shown to the left seems in comfortable repose. Below, the stone foundation of an ancient "canoe" house is illustrated



Soil and climate in the desert valleys of Arizona and Southern California combine to make ideal conditions for the propagation of dates of unexcelled flavor and quality. In 1900 the United States Government first interested itself in the possibility of growing this fruit in the desert stretches of the Southwest; today nearly 10,000 pounds of native dates are harvested from an acre of this once arid soil



Above: Transferring pollen from a male blossom to the female blossom. This must be done by hand, since nature has provided inadequate means for accomplishing this. In the wild state, it is done by the wind



Left: A cluster of ripening dates. All the dates in a cluster do not ripen at once, but are gathered separately as they mature

American Date Gardens

A staple food of the peoples of desert regions in the Far East becomes acclimated to the arid conditions of the American Southwest

By EMMY MATT RUSH

THE date palm is one of the oldest, if not *the* oldest, food-producing tree in the world. From time immemorial the people of the desert areas of the Far East have thrived upon its luscious fruit, and it has been utilized as a basis of food supply down through the ages of man.

When the United States Government began its search for a fruit tree that would withstand the arid conditions of the desert stretches of the Coachella Valley in the Colorado Desert of Southern California, Government horticulturists turned their search into the desert areas of the Sahara, Algeria, Persia, and the Nile Valley.

"Date of Light"

Numerous varieties of date palms were subjected to experimentation, with the result that today the greatest romance of the fruit industry of America is that of the date palm both in Arizona and more particularly, perhaps, in Southern California. Due to the virgin soil and the unique climatic conditions of the desert valleys of the Southwest, the date of America excels both in flavor and quality. In the Coachella Valley, especially, the silt of a prehistoric sea, the glorious sunshine of the area with its so-called "violet rays," and water, unite in producing some of the finest dates grown for the consumption of man. And of these, the far famed "deglet nour" . . . date of light . . . ranks supreme.

Concerning this unsurpassed variety of date, which is of far eastern origin, a legend comes down to us. A young maiden early in life lost her mother whom she loved devotedly, so the folk tale runs, and thereafter she went daily to the grave carrying with her a rosary made of a string of date pits. One day

she failed to return from her little pilgrimage of prayerful devotion. Seeking her there, her father, a date planter, found the girl lying dead across the mother's grave. Clashed within her hands was the broken rosary of date pits. In after years a new kind of date was found growing where the dead maiden's body had been discovered. It was a beautiful, bronzelike fruit, almost transparent, unlike any variety of date that the East Indian growers had yet produced. The father pronounced it "deglet nour" — the date of light.

The Coachella Valley, a veritable paradox of nature, glamorous and mystical, lies to the southeast of Los Angeles; as a crow flies, the distance is approximately 125 miles. Where drifting desert sands are blown by the caprice of desert winds, where cacti greet the gold and purple sage and grease wood and mesquite, where America's only native palms, the *Washingtonia Filifera*, dip their roots in the meandering streams that wander desert-ward from snow-clad heights of San Jacinto's rock-ribbed canyon walls, the conception and the culminating achievement of one of America's most heroic horticultural experiments has for its fundamental basis a territory rich in virgin soil and the silt of a prehistoric sea of a forgotten era. Here nature in her maddest, gladdest, and saddest of moods, makes manifest her variety, amid sand dunes ages old. It is here that America grows her dates.

The pioneer date grower

In the early days of the industry many enterprises failed. The discouragements which assailed the pioneer date grower are too dismal to relate and are known only to him. But he who defended his "lay-out" in the bottom lands of a prehistoric sea at the base of the Santa Rosa Mountains, with American pluck and determination, and trusted in that unique triangle of earth, sun,

and water, won the battle. The date grower of Coachella Valley plowed his way through sand dune, wind, and despair, to success.

The mountain streams of this area are dryer than rattling parchment during the summer months, the silt of the prehistoric sea "cakes" like a mass of glittering quicksilver under the powerful rays of the desert sun, and what has every appearance of a mid-winter snow storm, upon investigation proves to be the backwash of the ages, tiny white pearl-like sea shells, uncovered by the long arm of the desert wind!

Irrigation

With a summer heat that registers from 120° to 140° Fahrenheit, the date gardens of the Coachella Valley are irrigated every ten days. There is another East Indian legend to the effect that the date palm must have its feet in water and its head in the fires of heaven. The factors and elements of nature that for ages have nourished the thorn-covered flora of this region, today feed date palms that were brought here from Algeria and the Sahara.

The most remarkable native flora of the Coachella Valley desert, perhaps, is the beautiful native smoke tree. Found nowhere else in the world, it is said, except in the great Desert of the Sahara, the lacelike, thorn-tipped, bluish tendrils of this unique desert variety, was first called "smoke tree" by the early Spanish colonists who crossed the sands here en route to a new world, believing that they were approaching a desert fire.

The brooding, sweeping, sand dunes and the cacti-covered mesas, shifted by the caprice of the desert winds, are slowly but surely making way for date gardens of the modern American grower. From Santa Rosa's spurs as far as the eye can see, one beholds the broad expanse of the Colorado desert and its valley lands, the Salton Sea, and the coral-encrusted reefs with their cryptic inscription, and scattered across this wide range one beholds that more modern institution, the American date gardens.

It was soon discovered that the deglet nour, "date of light," imported from Algeria, best adapted itself to the climatic conditions of the Coachella Valley. More than three thousand acres planted to date palms now bearing fruit, set out in the trenches of the virgin soil of this great valley, today tell the

story of the startling and romantic career of the date industry in California. Sand dunes had to be leveled, underground desert waterways had to be tapped and the water brought to the surface, and young shoots set out.

Date culture has become a matter of horticultural study that carries the reader back to the year 1900, when the United States Government first began to interest itself in the possibility of growing dates in the Southwest. Today, thousands of tourists annually trek hither to see for themselves the actual achievement of this great horticultural enactment.

It is claimed that various species of dates can be arrived at only by the planting of seeds, each seed producing, strangely enough, perhaps another variety of date. At the same time, however, a desired species of date may be propagated by utilizing the young shoots that are sent out by the parent tree near its base. The parent tree will send out from five to twenty-five of these young shoots during the first ten to fifteen years of its growth. One date grower with a ranch near Indio, claims that his place boasts 119 varieties of dates grown from seeds.

Fruitage

After the young shoots have developed a root system of their own, they are in turn planted out in rows forty-eight to the acre, and one of the growers confided to me that it requires *eight years* and costs from \$4000 to \$6000 to carry *one* acre of date palms to the point where they begin to earn some money for the grower. You will decide that date culture is not a poor man's job. Be that as it may, a grower, it would seem, earns every cent his date garden nets him after the long years of labor, time, and money involved. The date palm, however, upon reaching the mature point of bearing fruit, rapidly begins to repay its owner.

The female of the species produces from eight to twenty blooms that hang like gorgeous festoons between the palm leaves. Each tree will produce from 100 to 350 pounds of fruit, depending largely upon the tree and the care it receives. A date palm in a well cared for garden will reach a height of from eighty to one hundred feet.

The male of the species does not bear fruit, and strange as it may seem, nature by some curious twist or caprice, has provided no

adequate means for transferring the pollen from the male blossom to the female bloom. And, notwithstanding the fact that the date palm is the oldest known cultivated fruit tree in the world, history tells us that it has been pollinated by hand, by man, for thousands of years. If you think a date grower doesn't work overtime, at all times, listen to what Mr. Date Grower told me about the process of hand pollinating the date palm.

"We cut the blossoms off the morning they open," said he. "Then we dry them, and we shake out the pollen. We then collect the pollen on cotton billets that look like powder puffs. The pollen is then dusted by hand on the female bloom within three days after it has opened."

The Coachella Valley date grower begins the process of hand pollinating his date palms about the fifteenth of February. This continues until about the first week in May. The fruit begins to ripen about the fifteenth of September, and this continues until about the first of January.

All of the dates on a cluster do not ripen at the same time. Each date, as it ripens, is hand picked from the cluster by Mexican pickers trained for this service. The fruit is carried in field lugs to the packing houses where it is thoroughly cleaned.

Sometimes some of the growers find it desirable to "process" their fruit, by giving it a coating of heavy syrup. The "unprocessed"

natural date, however, is more desirable, for it retains all of the qualities of the natural flavor, as well as its beautiful bronze cast.

Almost a complete food

It is claimed for the date that it carries a remarkable combination of the foods necessary for the human body. Sugar is associated in the date with protein, the necessary tissue builder; also iron, for the blood; lime, essential for the bones of the human body; and vitamins for nutrition and stimulation of growth. At the same time the necessary laxatives are not lacking in the date . . . no "pink pills" if a handful of tree-ripened dates are consumed. A date palm is at its prime when it reaches the ripe old age of one hundred, thus refuting all theories as to the uselessness of old age. It is said that there are date palms in the Mother country of the date whose ages run well into three hundred years.

Nature has not dealt unkindly with the Coachella Valley and the Colorado Desert land. Today approximately 10,000 pounds of native dates are garnered from one acre of this once arid soil, land apparently worthless only a short time ago . . . land that has been the homing place of rattlesnake, coyote, and wolf . . . land that is rapidly being reclaimed by American pluck and American grit. The spirit of the pioneer still lives.



*An American
Seedling Date*

The Petrified Forest

Turned to stone as they stood upright in the forest, layer upon layer of fossil trees form a fascinating display in a rarely visited part of Yellowstone Park

By WENDELL and LUCIE CHAPMAN

Photographs copyrighted by Wendell Chapman

THE term "petrified forest" usually brings to mind the colorful fossil logs in Arizona, the huge trunks in Napa Valley, California, or the scattered pieces in the vicinity of Cairo, Egypt. As a matter of fact, these displays are not forests at all in the true sense of the word. The term "forest" implies innumerable standing trees. The "trees" in each of these celebrated districts lie about in a horizontal position.

However, there is a district in Yellowstone Park and extending beyond, where forests have been entombed and the trunks have been petrified in an upright position. Roots of stone are embedded in stone, fossil leaves, twigs, and cones often lying about in the crumbling rocks. And these petrified forests are in layers, a dozen piled one on top of the other. Why then are they not better known? Why should such great natural wonders remain comparatively obscure?

There are several reasons. In the first place, the most remarkable displays of these forests are several miles from the roads, and are located in widely separated districts. In the second place, people who visit this section of the Rocky Mountains are attracted by the more widely publicized and more easily accessible phenomena of Yellowstone Park.

Moreover, the few local residents of the sparsely settled adjacent country who do visit the displays have little opportunity to advertise them. Furthermore, the vacation weather lasts but three or four months each year, and even the visitor with unlimited time does not have an opportunity to see everything within this enormous country.

Few members of the Park Service have been able to take time to visit the most remarkable exposures in the Gallatin Range which extended within and beyond the northern boundary of Yellowstone Park. This

corner of the Park was opened by highway only a few years ago. It is strange, however, that scientists making reports on the Fossil Forests of Yellowstone have failed to visit these most fascinating and abundant displays. In a short report of the Carnegie Institute as late as 1933, Charles B. Read made his observations from a district in the Lamar River Valley, apparently unaware of the superior displays in the Gallatin corner of the Park.

These forests, which would have become renowned and would have been ample reason for the establishment of a national monument if they were off by themselves, have been overshadowed by near-by painted canyon walls, magnificent waterfalls, the world's greatest geyser activities, and the most complete collection of wildlife in the United States. Some of the most interesting districts of these petrified forests are almost unexplored. Nature has been lavish in the Rockies.

Stumps from three to twelve feet in diameter dwarf the living trees, which seldom attain a diameter of three feet. These larger trunks suggest a very different type of vegetation in ages past, as indeed do the rest of the 150 species of fossil plants that have been found in the Park.

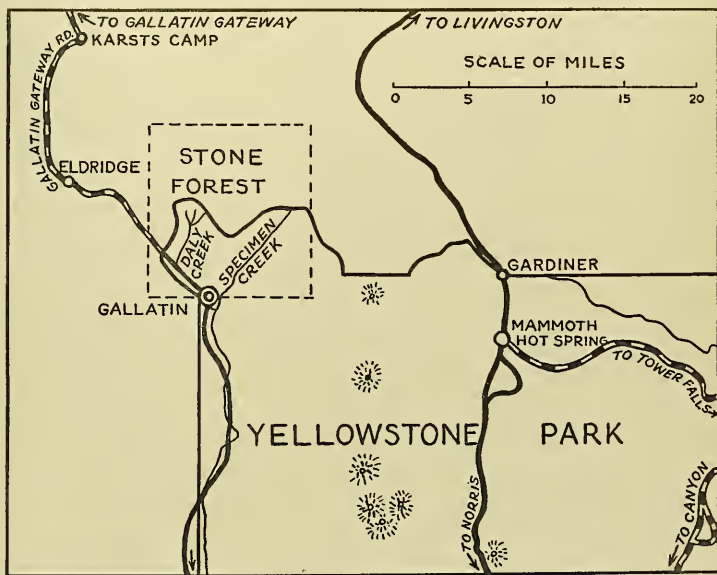
At present the forests are essentially evergreen, lodgepole pine predominating. Englemann and Douglas spruce are next in abundance. Two small varieties of pine, two of fir, and a juniper, which is in reality little more than a shrub, complete the list of evergreen trees growing there now. The deciduous trees are represented by quaking aspens and an occasional cottonwood. There are also willows, alders, a small birch, and shrubs.

In contrast to the predominately coniferous forests of the present, the fossil remains show that although the forests of the past contained three kinds of conifers — redwood, ewe, and pine, which apparently dominated in numbers, the greater variety was in the deciduous list. It included walnuts, hickory

nuts, poplars, birches, hazelnuts, beechnuts, chestnuts, breadfruits, oaks, elms, figs, magnolias, laurels, bays, cinnamons, sycamores, acacias, sumachs, persimmons, maples, and dogwoods, in addition to grapevines and many others. Such vegetation flourishes in a more moderate climate than prevails at present.

The largest stumps are from the *Sequoia magnifica* forests of recent geological times and are said to be a species undistinguishable from the redwoods growing along the coast of California today (*Sequoia sempervirens*). The prevalence of these magnificent trees which grow now in milder climates indicates that if people had lived in this region about a million years ago, they might have developed a superiority complex over their California climate. Undoubtedly they would have pointed out two or three different redwoods, each of which by ingenious qualifying conditions might have been "the biggest tree in the world." What a pity the climate, too, was not petrified!

The first white man to see and report these forests undoubtedly was James Bridger, one of the greatest mountaineers and rovers the West has ever known. It is thought that he first saw some of these petrified forests in the 1830's during his solitary wanderings. Few wonders escaped his notice, but his descriptions of the strange things he saw soon gained for him a Munchausenian reputation. Learning that people would laugh at his embellishments when they would not believe his facts, and having been naturally susceptible to megalomania which probably reached its very zenith in the early West, Bridger produced some whoppers. Spurred on by people's craving for amusement rather than instruction, he described the petrified forests of what was to become known as the Yellowstone region of the Rocky Mountains as "petrified birds a sittin' on petrified trees a singin' petrified songs in the petrified air. The flowers and leaves and grass was petrified, and they shone in a peculiar moonlight. That was petrified, too."



A PART OF YELLOWSTONE RECENTLY OPENED BY HIGHWAY

The "petrified forest," one of the less well known phenomena of Yellowstone Park, may be found within five miles, by trail, of the Gallatin Ranger

Station, on the main Bozeman to West Yellowstone Highway. The Ranger Station is indicated on the above map by the word Gallatin

Although Bridger's description was a bit magnificent, like the country in which he roamed and the statements of the acquaintances with whom he vied, the fact that he saw the petrified trees, recognizing and describing them as such, is indisputable.

"Old Jim Bridger's lies" concerning the petrified forests were found to be based upon facts when the Hayden Survey Party made a scientific study of the Yellowstone Park region in 1878. Mr. W. H. Holmes, who accompanied the party to make the geological reconnaissance, made a special study of the petrified trees. Although he was unable to find anything like a complete exposure of the superimposed layers, nevertheless, from the scattered stumps which he did see in the Lamar River Valley, he was able to visualize the strata.

He must have spent weeks gathering and piecing together fragmentary bits of information, before drawing the diagram which, with minor changes, is still used in geology text books. Had he only known it, a cliff some fifty miles to the northwest would have revealed almost the complete story, at least eight layers of petrified stumps being clearly visible from one spot. Holmes's diagram has induced many enthusiastic visitors to climb the celebrated Specimen Ridge overlooking the Lamar Valley, only to find a few petrified stumps. They, too, should know of the cliff which can now be reached by a ten-mile hike from the highway traversing the Gallatin corner of the Park.

Tremendous Eruptions

How these forests came to be preserved and piled on top of one another is explained by geologists to be the result of a series of tremendous eruptions similar to those which covered Pompeii. From craters or fissures dust and rocks were showered out in sufficient quantities to cover many square miles as much as fifty feet deep in a single "hail-storm."

As the rocks and débris came plunging to earth, they stripped foliage and limbs from the forests, leaving the standing trunks. Later, water eventually permeated the layer, carrying silica in solution and slowly turning the embedded trees to stone.

In some stumps the process of petrification has been interrupted, and in the same tree section is found perfectly petrified wood with

adjoining fibers of almost unaltered wood. Such incomplete silicification is undoubtedly due to an interruption of the necessary conditions, such as withdrawal of silica-carrying waters, rather than to insufficient lapse of time.

Petrification can take place quite rapidly under proper conditions, as is illustrated by the pieces of wood which have been in the silica-carrying waters of Yellowstone Park recently. When removed, these pieces often have the appearance of completely petrified wood, although, upon being dried and broken, some will burn. This stage of petrification has taken place in pieces known to have been thrown into the pools since the park was established in 1872 — which is no time at all as geologists figure it.

Buried Forests

To return to the buried forests, while petrification was going on beneath the surface, another forest was developing on the surface. After hundreds or thousands of years, when the trees were growing nicely, presto, another shower of rocks and ash, and a second forest was sealed in a layer of breccia for permeating waters to turn to stone. This reforestation followed by inundation of volcanic débris recurred over the same areas at least a dozen times and, although many thousands of years were required for the 5000 feet of these deposits to be laid down, still the whole series of eruptions probably happened within one or two short epochs of geologic time.

You may recall that geologic time is divided into four great eras, the last of which is divided into six epochs, the Eocene, the Oligocene, the Miocene, the Pliocene, the Pleistocene, and the epoch in which we live, the Recent. The fossil forests of the Yellowstone district have long been assigned to the Miocene. However, recent study has unearthed evidence that they may have been formed earlier, in the Oligocene or Eocene. (According to Read — *Carnegie Institute Report*, 1933).

A tourist who attended a lecture on geology in Yellowstone Park one evening after having visited the boiling caldrons, the hissing steam vents and the roaring geysers, was so much impressed by an account of these buried forests that she went trembling to the lecturer and asked if he thought there was any danger of another eruption coming soon. She was unable to conceal her worry over the

prospects of having her vacation violently interrupted. The speaker replied, "Madam, you have just heard how in the past when the country became well covered by forests, something broke loose, and, quicker'n a wink, down came the rocks and ashes. That's happened a dozen times. I'm superstitious about the number thirteen. Look all around you. See how nicely the trees are developed? Every time in the past when the forests got going like this, that was the sign for her to rip loose. You can see she's all set now. I look for her to pop at any moment."

The lecturer's intended humor overshot its mark, and the woman left paler than she came, departing from the Park early the following morning, undoubtedly after a sleepless night. Up to this moment, the forests are still growing nicely.

That the volcanic action was violent is indicated by the large, irregular rocks distributed throughout the finer materials forming the embedding breccia strata, as well as by the fact that no limbs or stubs have been discovered on the inundated tree trunks.

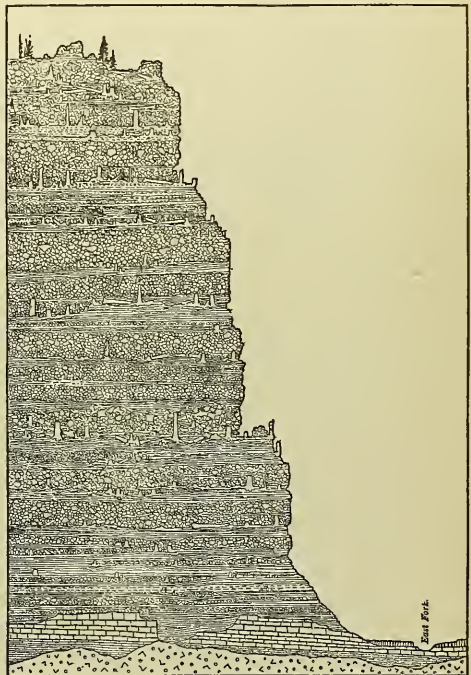
The absence of limbs might in a large measure be due to the shallowness of the strata. Many layers are only a few feet thick and would cover only the lower part of the trees where limbs are scarce. That the volcanic showers were accompanied by little, if any, heat, is thought by some to be indicated by the fact that only rarely are charred tree trunks found.

If heat were present, the portions which protruded above the layers would probably have burned. However, a heavy downpouring of débris would smother rapid oxidation of the covered trunks as is well illustrated by shoveling dirt on to a fire. The abundance of fossil leaves which show no signs of having been scorched may also indicate the absence of fire. But many delicate leaf impressions show no indication of having been battered by the falling material, either. Possibly they were engulfed in fine débris which protected them from

the larger missiles, or in the mud flows which often accompanies eruptions. However, the mud flows should be equally favorable to projecting limbs.

Possibly the leaves were dropped into ponds or swamps, or covered before the eruptions occurred, in which case they would show no effects of either violence or heat. These and many other problems have not yet been definitely worked out by geologists.

One of the strangest things in connection with these fossil forests, according to Dr. Clyde Maxwell Bauer, park naturalist of Yellowstone Park, and a geologist, is the fact that no mammal remains have been found, so far as he knows. He is inclined to believe, however, that such fossils will be found upon more thorough search of the deposits.



FOSSIL LAYERS

An ideal section through 2000 feet of beds of Specimen Ridge, showing succession of buried forest, as visualized by W. H. Holmes, 1878. An actual photograph of a similar deposit that has been uncovered through a long period of weathering appears on page 380

Mammal remains are very important to the paleontologist. During the last great geological era, when these petrified forests were formed, mammals came into their own. So quickly did they change in form during their evolutionary development, that each form represents an extremely short sub-division of geological time. Therefore, the discovery of mammal fossils would definitely indicate the age of the embedding strata.

When Wood Petrifies

Just what happens when wood is petrified is explained by some scientists as being a replacement, molecule by molecule, of the wood substance in solution. Others claim that the wood is not replaced at all, that silica filters between the solid parts of the wood and is deposited around the fibers, which always remain. When two such opposing scientists get together, they go round and round, each emerging convinced that his own particular brand of orthodoxy is correct.

Two years ago the writers discovered a specimen which neither "school" could claim. It was a piece of limb about eight inches long, two and one half inches in diameter, with a well formed scar out of which a branch had grown. The entire piece was of milky agate, with laminated layers, running not in the usual concentric rings, but straight across both ends. Doctor Bauer said it was a rare specimen, and explained the laminations running across the diameter thus: After burial the entire piece of wood had disintegrated and all of the wood structure had been removed. The perfect cavity resulting had not been altered nor filled until silica-bearing waters arrived to deposit horizontal layers of agate.

Many and varied are the displays of petrified remains in these Gallatin forests. One is the stump of a petrified redwood, ten feet in diameter, with the standing trunk of a dead tree projecting from the heart of the stump, and a small limber pine growing in the petrified stump beside the dead tree — trees from three generations. This ancient giant, modern ghost, and living weakling are near the top of a mountain ridge from which they overlook many rugged miles to the tip of the Grand Teton — a landmark in early days.

Near by are twin stumps, flaring together at the ground in Siamese union, so characteristic of the redwoods now growing on the

coast of California. In the breccia cliff above the twin stumps is one of the few trunks petrified in a horizontal position — an agatized log as beautifully colored as those in Arizona, but in lighter hues.

One giant stump sends into the rock foundation a partly exposed root which is larger in diameter than the trunks of the trees growing at the present time in the region. Some cross sections show perfectly preserved rings of growth. In one stump the annual rings curved irregularly around the trunk, as if tremendous pressure had caved it in unevenly from different sides without allowing it to break.

In the face of one cliff dozens of trunks stand out in bas-relief, from many different layers.

The most impressive tree of all is one discovered in the face of a projecting cliff by Dr. Paul Young of Montana State College. It stands like a pillar, as if holding up the great layer of rock which extends over as a roof. With partly exposed roots embedded in the cliff and the trunk extending up thirty or forty feet to the overhanging layer of rock, that tree appears to be defying the forces that are slowly tearing down the mountains.

Protection for Fossil Trees

One district, however, is disheartening to the visitor who wishes to see our natural wonders preserved. Near the northern boundary of Yellowstone Park a small, well-agatized stump stands within sight of the broad pathway which hunters have worn on the line while waiting for elk. Souvenir maniacs have broken off pieces from this stump, thus reducing its diameter by a third. Near by, several other stumps had been broken off piece by piece to the roots and carried off. Fortunate it is that the records of the past are so widely scattered and inaccessible, else long ago these tablets of stone would have been broken and carried away. And unless more protection is given to the most remarkable standing petrified forests known, eventually there will be little but desecration for the visitor to see.

A TREE TRUNK FROM ANOTHER AGE

On the opposite page is shown a tree that flourished probably during the Miocene. Its life-span may still be estimated today by its rings of annual growth, which show plainly

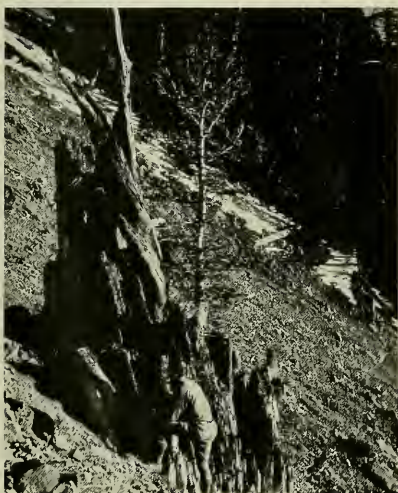




Above: A skeleton fossil tree in the Gallatin Mountain Range, which extends within and beyond the northern boundary of Yellowstone Park. The Grand Tetons may be seen along the distant sky line. The corner of the Park in which the fossil forest lies has been opened by highway only recently



Right: An agatized cross section of a fossil stump. The stumps that have been preserved from past ages vary in diameter from three to twelve feet, dwarfing the trees now growing near them, which seldom attain a diameter of three feet



A few miles from the widely known and easily accessible phenomena of Yellowstone Park lie remarkable and little known exposures of fossil tree stumps which were petrified in an upright position. In the photograph above at least eight different layers of petrified trunks are visible

Trees from three generations: the stump of a petrified redwood, ten feet in diameter, with the standing trunk of a dead tree projecting from the heart of the stump, and a small limber pine growing in the petrified stump beside the dead tree



Tree Trunks

According to some scientists this petrification has been caused by the replacement, molecule by molecule, of the wood substance in solution. Another theory is that the wood is not replaced at all, but that silica in solution filters between the solid parts of the wood and is deposited around the fibers which always remain

A tree trunk with typical embedding débris from the ancient volcanic showers of rocks and ash which in past ages brought ruin to a thriving forest. Rarely are charred tree trunks found, indicating that little, if any, heat accompanied these volcanic showers. If heat had been present, the portions protruding above the layers would have burned



of Stone

A pillar of the mountains which was discovered by Dr. Paul Young of Montana State College. It is one of the most dramatic sights of the whole stone forest, and might well be considered a monument to all the mighty trees that once flourished there. The overhanging strata plainly shows why the trunk is no taller

A close-up view of the tree trunk shown in the illustration at the left, photographed from the base of the cliff in which its partly exposed roots are buried. The trunk is about thirty feet high, and about a quarter of its diameter stands out in bas-relief. These large trunks suggest a very different vegetation in ages past from that of today



Above is shown the partly exposed root of a redwood stump seven feet in diameter. The root alone has a greater diameter than the trunks of the trees growing in the region at present. Below are two examples of fossil leaves, or leaf impressions, from the ancient

forests. Such well-preserved specimens are to be found in abundance. *Opposite page:* a view of *Sequoia sempervirens* (the same species that once flourished in the "petrified forest") as they grow today in the Sequoia National Park, Garfield Grove, California



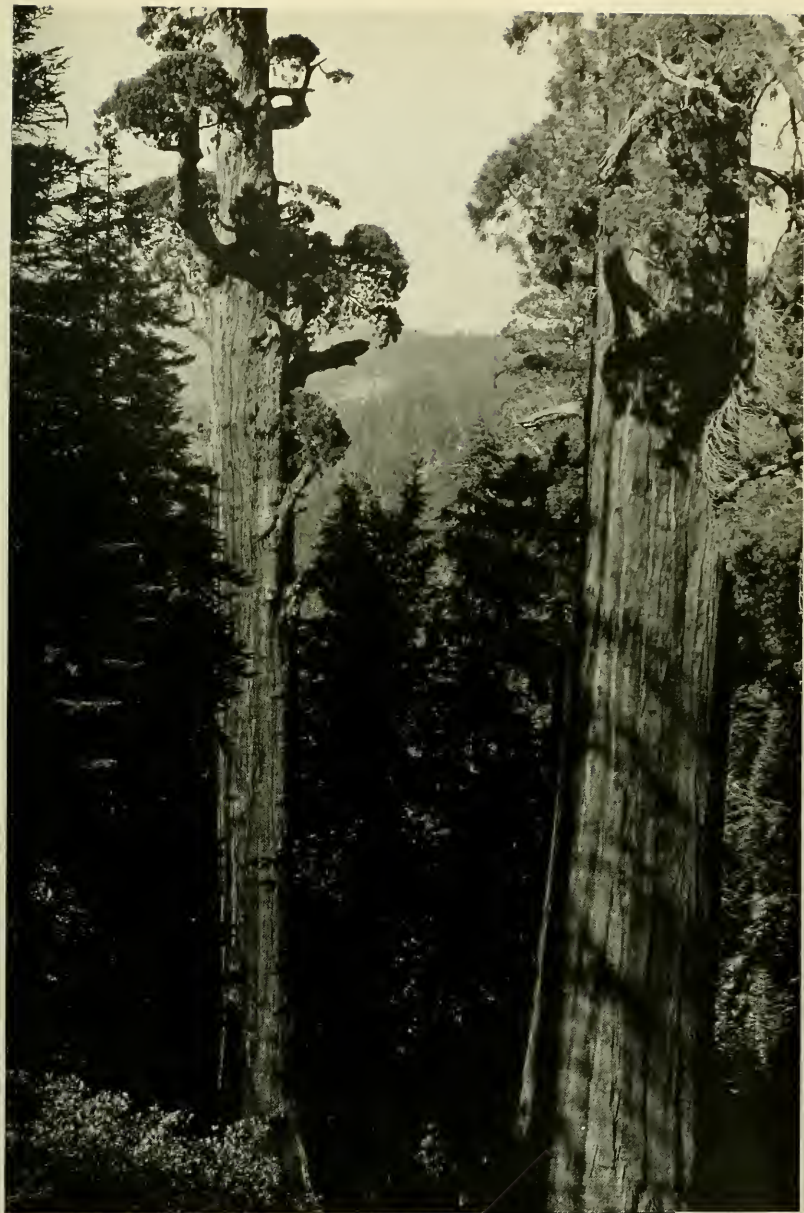
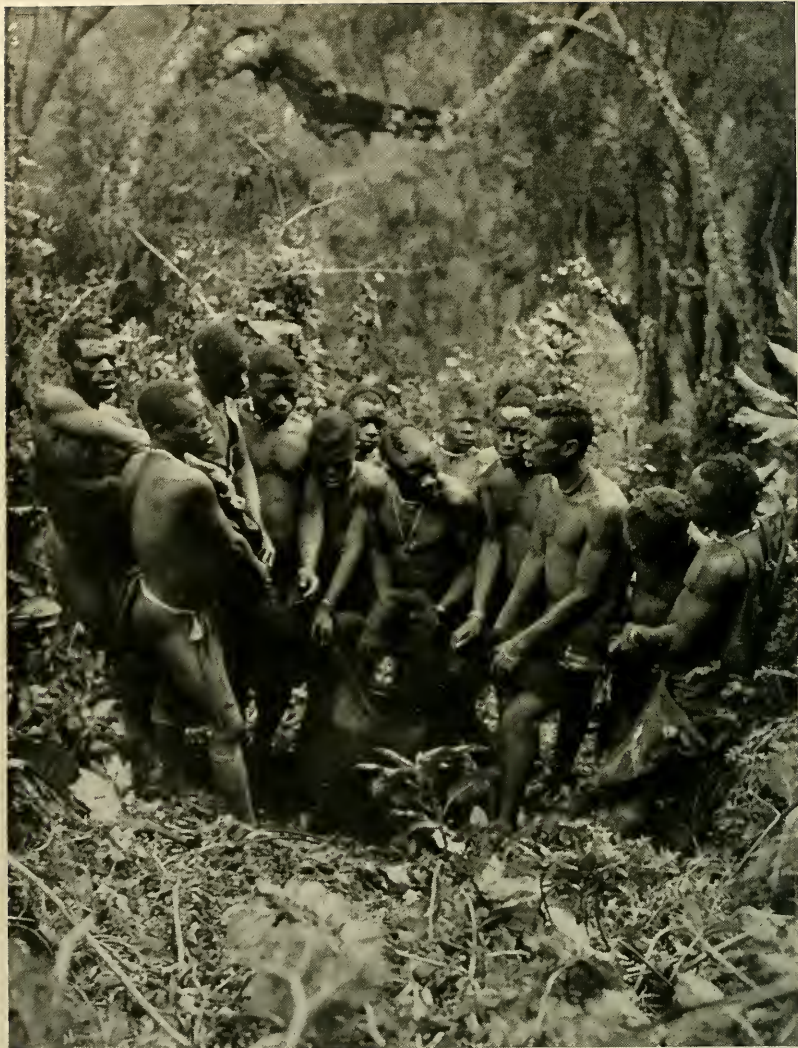


Photo by Willard G. Van Name



Photograph by Carl Akeley

COLLECTING THE GREAT GIANT OF KARISIMBI

The 400-pound gorilla, dominating Carl Akeley's gorilla group in the American Museum of Natural History. The background of the group was painted at this point

Conservation Expands in Africa

Carl Akeley's dream of absolute sanctuary for the vanishing wildlife of Africa is being realized.

By MARY L. JOBE AKELEY

*Secretary of the American Committee of Institut
des Parcs Nationaux du Congo Belge*

WHEN Carl Akeley secured his group of mountain gorillas (*Gorilla gorilla beringei*) in the Kivu District, Belgian Congo, for the American Museum of Natural History, 1921-22, he found the great apes occupying a region of surpassing wildness and beauty, unfit for agriculture and other human uses except to supply bamboo and firewood.

He believed this high mountainous area, rising abruptly from the plains below and containing all the zones of climate of the earth, ideal for a gorilla reserve and a biological survey station. Accordingly, in 1923, he prepared a plan of absolute sanctuary and submitted it to Dr. John C. Merriam of the Carnegie Institution, Washington, dean of conservationists and promoter of scientific research. "*Sanctuary is not sanctuary unless absolute*," said Akeley.

Doctor Merriam immediately recommended this plan to the then Belgian Ambassador, the Baron de Cartier de Marchienne, and with it submitted a statement covering the organization, history, and method of establishing the national parks of America. In 1924, Ambassador de Cartier began active efforts with the Belgian Government to the end that a Congo national park should be established — the first in all the great continent of Africa. Seconding the efforts of the Baron was the Belgian Consul General of Baltimore, The Honorable James Gustavus Whiteley, for whose unfailing assistance all American Museum scientific expeditions to the Congo owe a great debt. Finally, in 1925, His Majesty, Albert, King of the Belgians, created the Parc National Albert, in the area including Mounts Mikenso, Karisimbi, and Bishoki, for absolute protection of gorillas as well as all other wild life — plant and animal.

From the beginning President Henry Fair-

field Osborn had been in sympathy with the idea of gorilla protection. In 1927 Professor Osborn and the Trustees of the American Museum of Natural History endorsed the project of scientific research in the new park. In 1929 King Albert created the Parc National Albert as a *corporate body* in the Belgian Congo and in the mandated territory of Ruanda-Urundi for *strictly scientific purposes*. Since then the Parc has been administered by the Commission du Parc National Albert, an international body, and by a Committee of Direction. Professor Osborn and Doctor Merriam are members of the Commission.

The original gorilla sanctuary was ten miles square with an outlined protecting zone. After the survey conducted by the Akeley-Derscheid Expedition to the Kivu in 1926-27, the original area was increased from 24,000 hectares to 200,000 hectares, approximately 500,000 acres. Subsequent to 1929 Dr. J. M. Derscheid, then Director of the Parc National Albert, made two long and outstanding surveys of the new park and of other important areas to the end that other parks be established for the protection of such rare species as white rhino and okapi and the preservation of the beautiful Ruwenzori Mountains. On one of these important surveys, covering in most minute detail a vast extent of territory from Southern Ruanda-Urundi to the Southern Sudan, was Prince Eugene De Ligne. He had rendered invaluable service to the conservation project at the time the park was organized, was then President of the Commission du Parc National Albert, and is now Counselor of the Belgian Embassy in Washington.

In 1931 His Royal Highness the Duke of Brabant became President of the Commission. His extensive explorations of the Parc regions and his devotion to science are recognized in every land. With his elevation to the throne, he was succeeded as president by the distinguished scientist, Dr. Victor Van Straelen, Director of the Royal Museum of

Natural History, Brussels. Since 1925 rapid progress has been made in park affairs.

With a view to coördinating the management of the present and future scientific reserves and national parks in the Belgian Congo, His Majesty Leopold III, by Royal Decree dated November, 1934, created the Institute of National Parks of the Belgian Congo (Institut des Parcs Nationaux du Congo Belge).

This new body replaces the Commission du Parc National Albert and takes over the control of both the Parc National Albert and the new Parc National de la Kagera created in November, 1934 which lies in the mandated territory of Ruanda-Urundi.

The members of the former Commission of the Parc National Albert are designated, by the Royal Decree, as members of the first Commission de l'Institut des Parcs Nationaux du Congo Belge, and the membership has been enlarged from 18 to 24. Their term of office, with the exception of the president and secretary, is limited to six years, and retiring members are not eligible for reappointment until after the expiration of three years.

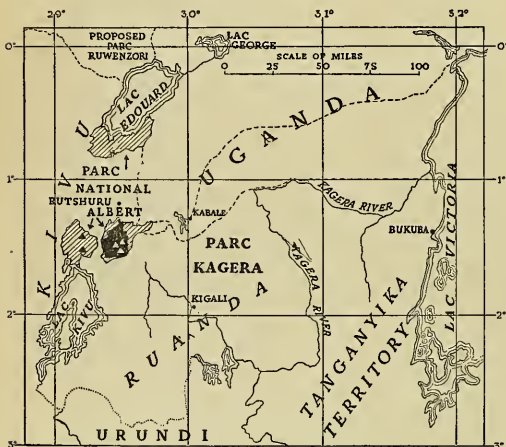
Doctor Van Straelen has been made president of the new Institute. Professor Osborn and Doctor Merriam are members.

The Parc National Albert has been enlarged, and its outlines revised so as to ex-

clude certain districts open to colonization or where the presence of natives would conflict with the purposes of the Park. The Park now includes 950,000 acres; the Parc de la Kagera 650,000 acres. In accordance with a suggestion made by His Majesty King Leopold III prior to his accession to the throne, application has been made to the government for the creation of another Park of 1,000,000 acres, west and north of Lake Edward, including the valley of the Semliki River and extending to the Ruwenzori.

Since certain portions of the area now occupied by the Parks are not especially useful for scientific purposes, the Institute will organize tourism in those sections and fix rates for permission to enter. During the year 1934, 166 persons entered the Parc National Albert, of whom 42 visited the volcanoes Nyiragongo, Nyamagira, and Rumoka; 8 visited Mt. Mikenko; and 66 visited Lake Edward.

By the liberality of a few Belgians interested in the Congo Parks, an organization has been formed under the name of the "Fondation pour favoriser l'Etude scientifique des Parcs Nationaux du Congo Belge" for the purpose of aiding scientific expeditions. The present annual revenue from this fund is 250,000 Belgian francs or approximately \$10,000.



This map shows the three sectors of the Parc National Albert, the newly created Parc Kagera and the proposed Parc Ruwenzori. The area in black is the original Gorilla Sanctuary proposed by Carl Akeley. The small black triangles indicate the active volcanoes Nyamagira and Nyiragongo. The white triangles show the location of the three extinct volcanoes Mikenko, Karisimbi, and Bisoke.

Fortune and Misfortune in Antarctica

Adventures and discoveries of the 1934-35 Ellsworth Expedition to Graham Land

By LINCOLN ELLSWORTH

Trustee of the American Museum

THERE are so many interesting facts about the great unknown continent of Antarctica that few people realize their significance and volume by merely looking at a map of this great polar region. To start with, Antarctica is quite a sizable place. In fact, it is 5,000,000 square miles in area — or as large as Europe and Australia put together.

In contrast to the North Pole, which is an ocean surrounded by continents, Antarctica is a continent completely surrounded by water. One of the interesting features of the Antarctic is that the South Polar Plateau lies 10,000 feet above sea level while the North Polar region lies 10,000 feet below sea level. By that I mean that the ocean at the North Pole is from 10,000 to 12,000 feet deep. I speak from personal observation, for in 1925, when Amundsen and I were forced down 120 miles from the Pole, we took two soundings and found depths of 12,000 feet.

Asia has been called the "Roof of the World," yet Antarctica is on the average twice as high as Asia and seven times as high as Europe. This vast continent, locked in the grip of everlasting winter and covered with an ice cap which is estimated to be more than a mile and a half in thickness, is 90 per cent unexplored.

The 1933 Expedition

The base of my first Antarctic expedition was the Bay of Whales in the Ross Sea. I planned to fly the 1450 miles from there to the Weddell Sea, because I wanted to learn, if possible, if these two great seas meet and thus divide Antarctica into two parts. Another problem that interested me was whether the highlands of Graham Land, which are considered to be a continuation of the Andes of South America, continue on across Antarctica to join the mountains of Victoria Land. It is possible that the Queen Maud

Range is a part of these mountains.

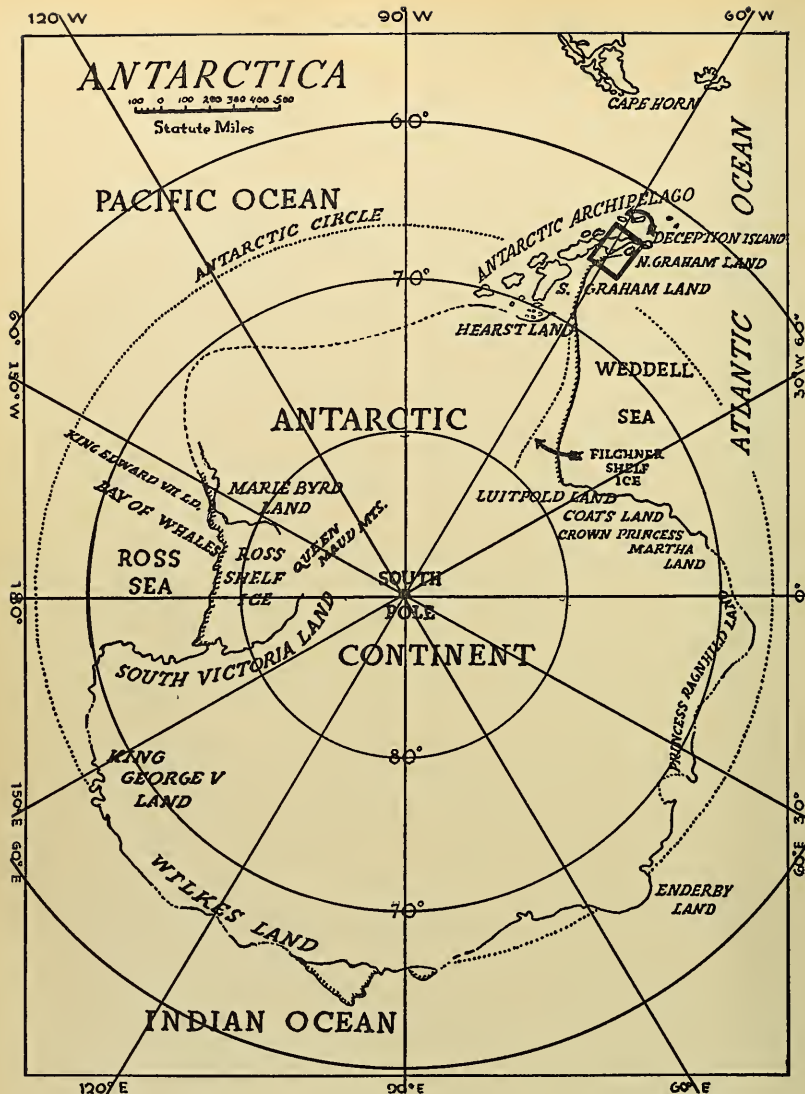
We sailed south from New Zealand December 10, 1933, aboard the "Wyatt Earp," but were held up by the great pack ice leading to the Ross Sea until near the middle of January. That made it too late for a season's exploration journey such as I had planned. So this year I decided to reverse my program and fly from the Weddell to the Ross Sea, selecting Deception Island as my base. This remote and uninhabited island lies just 600 miles south of Cape Horn and is separated from South America by the stormiest ocean in the world.

Deception Island, 1934

After an uneventful voyage of 5000 miles across the lonely, storm-swept South Pacific from New Zealand, where the ship had wintered after her return from the Ross Sea, we arrived at our new base in Deception Harbor on October 14, 1934. We had been looking forward to finding decent spring weather there, but instead, winter conditions with gales and snow squalls still prevailed.

Deception Island is bare and desolate except for the buildings of an abandoned Norwegian whaling station that has not been used since 1930. It is a known fact that about 100,000 whales have been killed in Antarctic waters during the past twenty-five years, and there are thousands of whale bones in this harbor, with the result that the stench at low tide is terrible. Besides being the graveyard of whales it is also the graveyard of whalers. A tall monument was erected on the island in memory of the crew of an entire ship that was crushed in the Weddell sea pack and went down with all hands aboard.

It was a week before we could get the "Wyatt Earp" through the ice-cluttered harbor and up to the dock to unload the plane. The "Wyatt Earp" is a fine little exploring ship. I named her after the great frontier marshal of Tombstone and Dodge City. He was the most efficient peace officer



THE ELLSWORTH 1934-35 EXPEDITION

The small square at the upper right represents the scene of Lincoln Ellsworth's exploratory work. The flight added five islands, three deep fjords, and several conspicuous

mountain peaks to the sum of human knowledge about the Antarctic; a more detailed map of these discoveries appears on page 399

and the greatest gun-fighter the West ever knew. It is an odd coincidence that I named my ship after him before I learned that Wyatt Earp held his first frontier job in Ellsworth, Kansas.

We spent a week unloading the plane and another week assembling it. Again luck was against us, for no sooner had the motor been started than a connecting rod between the piston and the crankshaft broke. An extra connecting rod was not to be found, for it proved to be the sole item not included among the extra parts we took with us.

Merely because a little strip of steel was forgotten, our boat had to make a voyage of

1800 miles to South America and back in order to replace this part. The "Wyatt Earp" made the round trip in sixteen days, due to the exceptionally favorable weather, which completed 28,000 miles of voyaging for her since leaving Norway, July 29, 1933. All these miles in quest of a twenty-hour flight!

While the boat was gone, we assembled the emergency supplies to be carried on the flight in case of a forced landing. A hand sledge was loaded with emergency rations sufficient to last two men two months. The load weighed just 500 pounds.

Among the delicacies we dined upon during



REGION OF EXPLORATION

The territory left of Cape Longing was discovered by Lincoln Ellsworth on his flight of January 3, 1935, in the "Polar Star." Because of adverse weather condi-

tions, Ellsworth and Bernt Balchen, the pilot of the expedition, were forced to wait five weeks before this flight could be made

our stay on Deception Island were penguins and their eggs. There are thousands of penguins on the island, in fact, it is one great rookery. Penguins are funny, fearless, and friendly fellows. They stand with their eggs between their feet and hatch them that way because they do not build any nests.

On learning that the penguins would put up a fight if we tried to take their eggs away without giving them something in return, we really developed quite a technique at egg-snatching. We would go up to a penguin and, while gathering the egg with one hand, would shove a hat under the bird with the other; then quickly pull the hat away again. A penguin egg is about the size of a duck egg and is good eating when fried or made into an omelette. But steer clear of a boiled penguin egg!! It has the consistency of rubber and tastes like strong fish.

Delay

Our delays at Deception Island were costly. Day by day the snow melted, and with miserable weather prevailing — anything but flying weather — we abandoned all hope of a take-off. So, with the assembled plane loaded on deck, we lifted anchor on November 28 and headed south for regions more favorable, or so we thought.

We traveled 150 miles south along the west coast of Graham Land and tried to reach Port Lockroy but could not get there because of the ice pack. We set a northward course, passed through Antarctic Sound, and as the ocean in that neighborhood this year — early in the season — was remarkably free from ice, we were able to go into the Weddell Sea and go as far south as Snow Hill Island.

Snow Hill Island is one of the most interesting spots in Antarctica — a small dot in that vast region of ice and snow — made famous by the expedition of the great Swedish explorer, Nordenskjöld. One of our most dramatic moments on Snow Hill Island was finding Nordenskjöld's hut thirty-three years after he wintered there in 1902 and 1903.

Nordenskjöld's ship, returning to pick him up after his first winter there, was crushed in the ice. This meant that he and his party of five had to spend a second winter in the Antarctic. We could reconstruct the helter-skelter scene as the men made a mad rush to reach the rescue ship, an Argentinean gun-

boat, that reached them just in time to effect their rescue before the ice shut them in for the third winter.

Three dogs lay just where they had been shot thirty-three years ago. Their bodies were mummified and still covered with white hair. Hats lay where they were dropped — a pair of boot-trees were there, and the most amusing thing was a pair of ice skates. Unopened sardine cans and packages of chocolate also lay about. We didn't bother with the sardines, but the chocolate was still good. We also found an old-fashioned phonograph and a dozen wax records — but even in Antarctica the tunes were terrible.

The hut itself was a bare little dwelling, gyved on the four corners with steel cables. This was done to keep the hut from being blown away. A sound precaution, for in his book, Nordenskjöld speaks of ninety-mile gales that roared for weeks at a time.

When we looked through one of the small windows into the hut, we were amazed to see nothing at first but a huge block of blue ice that almost filled the interior. How that ice came to be there we never could discover. A large timepiece hung on the wall and the hands pointed to three o'clock. We took it down, set it going, and it ticks away now, just as it did thirty-three years ago.

The Nordenskjöld Fossils

The purpose of Nordenskjöld's expedition was to search for fossils on Snow Hill Island and plenty were discovered. We, too, found quite a few fossils and they tell a strange story, — that Antarctica once had a sub-tropical climate. The waters were warm, the land was green, and both land and water teemed with life. Mighty trees covered the land — but that was 75,000,000 years ago.

In all, we brought back about 200 fossils. They included about 50 species of shell fish and several pieces of petrified wood. These specimens were turned over to the American Museum of Natural History to be studied by Dr. Chester A. Reeds, curator of invertebrate palæontology.

The thing that astounded me most in finding these fossils was that they were of creatures which showed signs of having been fat and well-nourished. Naturally I asked myself the question, "What sudden catastrophe could have overtaken this land, rich in ani-

mal and plant life?" So far, I have not found the answer.

Of course, our hunt for fossils did not start until after we moored the "Wyatt Earp" to the front of the glacier which runs to the very edge of the island, unloaded the plane, taxied it up to the plateau above, a mile and a half inland and 600 feet above sea level. There we found the snow firm and suitable for our take-off.

Next, all hands manned the sleds and hauled two tons of gasoline and oil up the steep slopes. It was a hot and back-breaking job, for although the Antarctic summer at sea level hangs about ten degrees below the freezing point, the sun's reflection on the snow throws off quite a little heat.

We put up a tent close to the plane in which four of us planned to live in order to carry on with the flight if it became a question of the boat having to leave on account of menacing ice conditions. We made a few test flights and were all set to take off but could not leave because the weather became almost unbearable. To add to our troubles, the ice front commenced to break off and the "Wyatt Earp" was forced to move out to safe anchorage.

For ten days a gale ranging from twenty-five to fifty miles an hour blew, accompanied by snow, so that all we could do was to stay aboard and gaze longingly southward upon the ice-studded expanse of the Weddell Sea for just one break to get into the air. Our very existence became a game of "patience" — our only weapon against the unpredictable and uncontrollable forces of nature and the elements.

The only visitor we had in the Weddell Sea was an emperor penguin. This bird is one of the most remarkable animals living. Among other things, it lays its single egg in the dead of winter so that the young will be large enough to take care of itself the following winter. Both fathers and mothers fight to take care of the young, and the poor infants

are so mauled with love that they frequently seek shelter in the crevasses of the surrounding rock to escape destruction. The mortality rate must be very high, because young penguins are often found frozen to death in these refuges — victims of parental love.

Misfortune

Finally, on January 3, 1935 — after five weeks of weary waiting — our chance came. But we lost it because it took us a long time to get the "Polar Star" with its total load of 6698 pounds into the air. The new snow, which had fallen on January 1, had drifted into low *sastrugi* in patches on the glazed surface of Snow Hill Island Barrier, and they acted as would a series of morasses on a regular landing field. Each one slowed up the speed of the plane with a marked tendency to turn the machine over on its nose. Time and time again, Balchen brought the airplane



HARDSHIP HOTEL
Deception Island
100 Rooms 1 Bath
Hot Air Heat
Winter Sports
Hot Spring Bathing
Norwegian Cuisine

Table d'hôte
November 15 1934

Cream of Asparagus Soup à la Hardship House
New Zealand semi-ship's Biscuit

Roast Pork Tahitian Sauce maître d'hôtel
Browned Potatoes

Spring Salade Deception Island
Tyttebaerayltetoei Black Currant Jam

Bpekepoles very very old
Demi-whole wheat Bread Chef Balchen

Sweet butter Old Cheese
Fruit Compote à la marooned party

Petitote Gâteaux Cafe Royale
Bon bone Froie
Tabac Virginia

Cuisine Staff

Chefs: de cuisine: *Rene Balchen* Ganymede: *Jürgen Helmer*
de ecullerie: *Sven Balchen* Lazarus: *Dana Coman*

Oven Chauffeur: *Chris Braathen*

A BANQUET AT THE ANTARCTIC

A decorative menu evolved by the commissary department of the Expedition

into the wind which was blowing down the slope of the best take-off area, but we could not get off on the up-grade.

Once Balchen turned his head and yelled: "Look out! I think we will turn over." I made sure my safety belt was tight and braced myself, but — nothing happened.

Discoveries

After almost an hour of taxiing, Balchen turned to a dangerous downhill slope on the southern side of the island and in a side wind opened up the 525 H.P. Wasp motor. With our movable pitch propeller set at the most advantageous angle, we finally got clear of the sticky surface. A little earlier in the afternoon the prospects had seemed excellent, but when we reached an altitude of 3000 feet, we saw a snow squall to the south. It blocked our path as effectively as if it had been a stone wall. The only thing to do was to go as far as possible and to do as much new work as opportunity would allow. Hence, after circling the "Wyatt Earp," we crossed Snow Hill Island, Lockyer Island, and flew over the glacier-fringed southern end of Ross Island to Cape Longing. Then we skirted Sobral Island, passed over Lindenberg Island, and between Robertson Island and Seal Nunataks. Here the clouds closed in above us and light conditions were extremely bad. In a few minutes we could see more squalls descending and we turned southwestward to follow the edge of the storm.

Without going into protracted details about the flight, let me say that it added five islands, three deep fjords, and several conspicuous mountain peaks to the sum of human knowledge about the Antarctic.

The ice-encrusted Antarctic seems vast and vague to those who have not seen it. But until you fly a mile above its surface, thereby extending actual vision of conditions across a diameter of several hundred miles, it is impossible to comprehend the vastness, the might, and the seeming unconquerableness by puny man of this ice-bound world over which we soared on man-made wings.

After our flight, which lasted two hours and a half, we stayed on the island as long as we dared, hoping for another chance. But it never came. In a few days, the ice began to come in — huge icebergs that drifted toward us in ghostly silence and soon covered the surface of the sea.

On the 10th of January we knew that our time was up if we were to get back home, and on the 13th, we pulled the anchor up and tried to get out. Our attempt was unsuccessful. After journeying sixty miles, we were turned back to Snow Hill Island by heavy pack ice. The next day we tried again. The sea was covered with solid ice floes that measured many miles in each direction, but Providence was with us. That day we got as far as Vega Island, a matter of about 100 miles. At Vega Island the ice closed in on us again. We could not go ahead. We could not turn back. We were caught and we were almost done for. After talking the situation over, we agreed that the best thing to do was to prepare to abandon ship. We all worked furiously throughout the night, checking emergency rations and preparing packs with which to struggle over the ice or drift on a floe to open water where, with our life boats with us, we could take to the sea.

We were ready to abandon ship, but about four o'clock in the morning the wind changed. Instead of sweeping ice down upon us, it swept it away. That was a change in our favor. We knew that to go on was courting trouble, but realized it was a risk we had to take. Mile by mile we worked our way northward, and, at last, after a trip that seemed like centuries, but lasted only a day and a night, we got out of the treacherous Weddell Sea into the clear waters of the South Pacific.

Lure of the Unknown

In retrospect, our recent exploration stirs us with mingled feelings. I suppose it is only natural that our satisfaction over the safe accomplishment of a difficult thrust into the borders of the largest unknown area on the face of the globe should be tinged with the inquietude of curiosity not fully satisfied. It is this unresting curiosity that has always driven explorers toward the complete discovery of every land and every sea, and toward the full utilization of the resources which are man's heritage on this planet. There is satisfaction, to be sure, in having added the results of this expedition to the sum total of knowledge. And perhaps I should be content in having taken part in five polar expeditions. Yet the lure of the unknown still beckons.

Penguin eggs were one of the Expedition's food staples on Deception Island. Boiled penguin eggs taste fishy, but scrambled or made into an omlette they provide a pleasant change in the diet



Below: Making a test run on Deception Island. It was shortly after this test was made that the connecting-rod

broke, which necessitated a long journey to South America for a strip of steel that weighed less than five pounds





Unloading the "Polar Star" on the shelf ice at Snow Hill Island



Dragging the supplies up the steep slope from the sea was a gruelling grind



The breaking of this small piece of steel prevented the take-off from Deception Island. Below: The "Polar Star" waited week after week to rise into the air



Blizzard after blizzard kept the party grounded; between blizzards the men were busy digging out the plane. Below: The snow shelf turned into a frozen Niagara





Wild Animals of the Hudson Highlands

Millions of persons visit the Hudson Highlands each year. By far the great majority come to the Bear Mountain — Harriman Section of the Palisades Interstate Park, pictured above. Here the majestic Hudson flows through a narrow gorge between gracefully rounded mountains. The slender iron strand of the Bear Mountain Bridge crosses the river in the center of the area and here, in the shadow

of the bridge towers, lies the approach to the Bear Mountain Trailside Museums and Nature Trails. Trailside visitors are invariably surprised to learn that there are thirty-eight different kinds of wild mammals in this area, despite the fact that the teeming sidewalks of New York City are but forty-five miles away. Some of the mammals are pictured in the following pages. Photograph by Leroy Davies

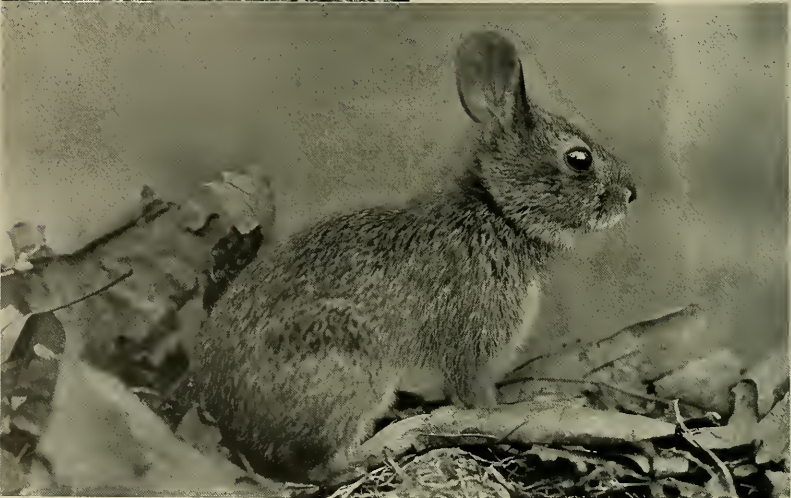
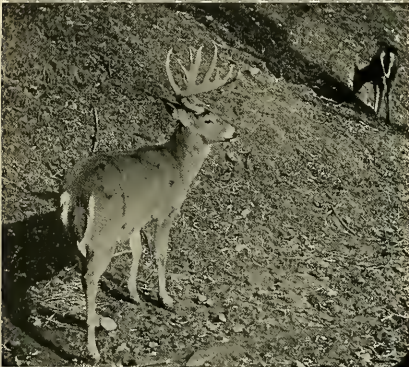
Park Residents All

The erect beaver on the left is representative of many of his fellows occupying ponds throughout the Palisades Interstate Park. Beavers were re-introduced into the region in 1920 and have thrived. It is estimated that they have spread in a hundred-mile radius.

Photograph by Clyde Fisher

The Virginia deer, on the left, is familiar to park visitors. In 1910 it was believed that no deer existed in the Highland region. Today the wild deer are numbered by the hundreds, and motorists especially are delighted to view the animals from the roadside in many sections

Cottontail rabbits are numerous and are the particular joy of park campers. On summer evenings the nimble rodents may be seen about camp buildings, open fields, roadsides, and lawns. Photograph by Mary C. Dickerson





The woodchuck above is another mammal frequently seen feeding or moving about beside the highways wherever open grassy spaces prevail. Trailside Museum visitors often describe this animal and inquire as to its name. Woodchucks are seen most frequently in the fall. Photograph by Mary C. Dickerson

The chipmunk, nicely posed below, has benefited by the remains of many picnic lunches left by park visitors. A question often asked is "What is that little brown animal with stripes down its back, that scolds us when we walk along the Nature Trail?" The answer is "The Chipmunk." Photograph by Mary C. Dickerson



"Virginia," the gray fox, is a resident of the Trailside Museum zoo. There are many wild foxes, both gray and red, living in the park area, but they are wary creatures, not often seen by the casual visitor. Photograph by Peter Keane



The gray fox, left, often preys upon the little mouse shown below. Photograph by Peter Keane

The white-footed mouse visits camp buildings in search of food and shelter. It is an attractive animal, dainty and well marked. The white-foot is to be found throughout the entire region. Photograph by Mary C. Dickerson



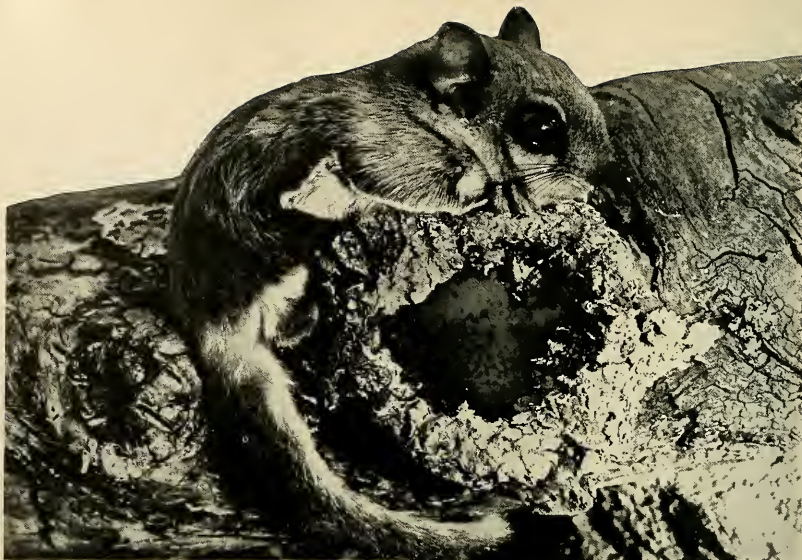


"Coco" the tame raccoon has been with the Trailside Museums for six years. Wild 'coons still wander through park woodside at night. Their footprints are to be seen on banks of many water courses. Photograph by Peter Keane

Campers have learned that the skunk will "mind his own business," when undisturbed. Photograph by Peter Keane



The jumping mouse is a nocturnal animal rarely seen, even by campers. It is believed that it is more common in the Park than eye-witnesses' records would indicate. Photograph by Mary C. Dickerson



The flying squirrel is one of the most attractive members of its family. Its ability to glide through the air has amazed many observers. Photograph by Mary C. Dickerson

MAMMALS LIVING IN A WILD STATE WITHIN FORTY MILES OF THE GREATEST METROPOLITAN AREA IN AMERICA, IN THE CONFINES OF THE BEAR MOUNTAIN — HARRIMAN SECTION OF THE PALISADES INTERSTATE PARK

- Opossum, *Didelphis virginiana virginiana* Kerr.
Common mole, *Scalopus aquaticus aquaticus* (Linn).
Star-nosed mole, *Condylura cristata* (Linn).
Common shrew, *Sorex cinereus cinereus* Kerr.
Smoky shrew, *Sorex fumeus fumeus* Miller.
Short-tailed shrew, *Blarina brevicauda brevicauda* (Say).
Little brown bat, *Myotis lucifugus lucifugus* (LeConte).
Silvery bat, *Lasionycteris noctivagans* (LeConte).
Georgia bat, *Pipistrellus subflavus subflavus* (F. Cuvier).
Big brown bat, *Eptesicus fuscus fuscus* (Beauvois).
Northern red bat, *Nycteris borealis borealis* (Müller).
Hoary bat, *Nycteris cinerea* (Beauvois).
Raccoon, *Procyon lotor lotor* (Linn).
Bonaparte weasel, *Mustela cicognani cicognani* Bonaparte.
New York weasel, *Mustela noveboracensis noveboracensis* (Emmons).
Common mink, *Mustela vison mink* (Peale & Beauvois).
American otter, *Lutra canadensis canadensis* (Schreber).
Eastern skunk, *Mephitis nigra* (Peale & Beauvois).
Eastern red fox, *Vulpes fulva fulva* (Desmarest).
Eastern gray fox, *Urocyon cinereoargenteus cinereoargenteus* (Schreber).
Bobcat, *Lynx rufus rufus* (Schreber).
Woodchuck, *Marmota monax rufescens* Howell.
Chipmunk, *Tamias striatus fischeri* Howell.
Southern red squirrel, *Sciurus hudsonicus loquax* Bangs.
Northern gray squirrel, *Sciurus carolinensis lucotis* (Gapper).
Eastern flying squirrel, *Glaucomys volans volans* (Linn).
Beaver, *Castor canadensis canadensis* Kuhl.
Northern white-footed mouse, *Peromyscus leucopus noveboracensis* (Fischer).
Allegheny wood rat, *Neotoma pennsylvanica* Stone.
Red-backed mouse, *Clethrionomys gapperi gapperi* (Vigors).
Eastern meadow mouse, *Microtus pennsylvanicus pennsylvanicus* (Ord).
Muskrat, *Ondatra zibetica zibetica* (Linn).
House mouse, *Mus musculus musculus* (Linn).
Norway rat, *Rattus norvegicus* (Erxleben).
Meadow jumping mouse, *Zapus hudsonius americanus* (Barton).
Woodland jumping mouse, *Napæozapus insignis insignis* (Miller).
Eastern cottontail rabbit, *Sylvilagus floridanus mal-lurus* (Thomson).
Virginia deer, *Odocoileus virginianus virginianus* (Boddart).

5000 Years of Exploration

*The story of world discoveries as told in "Unrolling the Map,"
by Leonard Outhwaite*

By HAROLD WARD

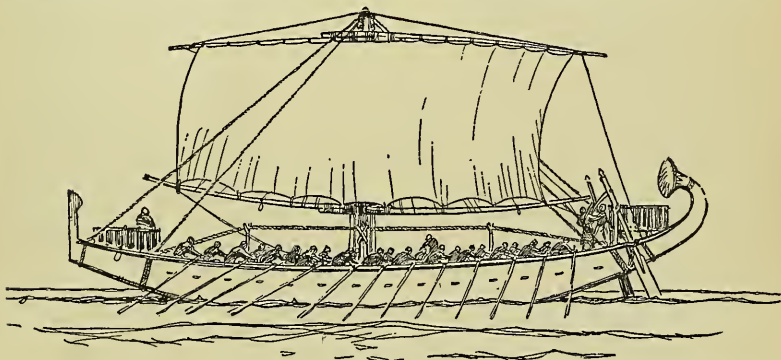
All photographs from Unrolling the Map

THE HISTORY of Exploration is the record of man's unconquerable courage in the face of the Unknown; of his insatiate hunger for the new, the untried, the remote, and the dangerous. Whether the motive be gold or glory, whether the end be the advancement of knowledge, political aggrandizement, or economic domination — or all three in diverse combination — Exploration is man's answer to the infinitely varied, never-to-be remitted challenge of Nature. The whole of Science may be comprehended in that answer — provided we so define it as to include the ideas of Rigor and Precision, of endless patience in the quest of relevant facts and ordered daring in their interpretation. "Explorare": to search out and bring to light; more literally, *to make flow* what before was stagnant, or frozen, or any way withdrawn from the curiosity and needs of men. To get at and reveal the source of things — of everything, from the energy of cosmic rays to the constitution of the stars; from the stratosphere to the headwaters of the Nile —

To unroll the Map of the World!

There, indeed, is a story made to grip the somewhat jaded attention of Twentieth Century *Homo sapiens*, who takes his Atlas too much for granted and whose need for adventure must be vicariously satisfied by going "half a mile down" with William Beebe — or ten miles up with August Piccard. And that is the story — five thousand years of it — which (if he be really "sapi-ent") he will make haste to read in the handsome volume before me: *Unrolling the Map: the Story of Exploration*, by Leonard Outhwaite.

Mr. Outhwaite — an experienced traveler with a thorough grounding in geographic and anthropological knowledge — has, in his scholarly book, gone much further, and fared decidedly better, than Hendrik Willem Van Loon, whose picturesque geographic primers have a way of making two questions grow for every one they partly answer. The reasons for this are not far to seek. In the first place Mr. Outhwaite's enthusiasm for his subject is that of a student who has honestly accepted the discipline which it imposes, and who has, accordingly, learned how to avoid



Used about 1500 B.C., on the second known Punt expedition. Lack of strong timbers for proper keel pieces necessi-

itated the rope truss passing around the raised bow and stern and stretched just above the oarsmen on two crutched poles



AROUND AFRICA, 600 B.C.

Reasonable evidence exists that Phoenician sailors under the orders of King Necho of Egypt voyaged around the

whole shores of Africa about 600 B.C. The journey, it is believed, took about three years

patronizing his readers. Secondly, under his skilful and dramatic narrative treatment Geography becomes not merely a live subject but a *dynamic* one: each of the fifty-six outline maps shows the world actually growing in response to the urgency of new explorers coming from greater and greater distances. Thirdly, the encyclopedic range of the volume, both in time and in space, although resulting in many omissions and considerable telescoping of what remains (we are almost never informed as to the *areas* of the newly-discovered lands, and information is sadly lacking on the *distances* covered by various expeditions) — this range does give the reader a panoramic view of human exploration which he is unlikely to obtain in so fascinating a form from any other single book.

So much for generalities. But here are the maps: let us, with Mr. Outhwaite, unroll a few of them: regretting, perhaps, that none is supplied with scales of distances in miles, and that only the world maps carry latitude and longitude notations.

We begin in the Mediterranean area,

around and near which clustered the early Empires: Egypt, Phoenicia, Assyria, Sumer, Elam, legendary Crete and the Greece of Homer. From the first of these started on his travels, about 2750 B.C., the enterprising Hannu, who sought wealth and adventure in far-off Puoni, the "Land of Punt," whence he brought back much gold and silver, myrrh, and many precious woods. Today portions of this "Holy Land" of the Pharaohs, under the name Abyssinia, are bitterly harassed by a government whose people commemorate in their name the deeds of an antique tribe — the Italic. More than 2000 years later — but still a good 600 years before Christ, another Egyptian, King Necho, sponsored one of the most remarkable expeditions in all history: the circumnavigation of the African continent by unknown Phoenician sailors. Herodotus, who narrates this three-year feat in a single paragraph of his famous History, had his doubts: oddly enough (as Mr. Outhwaite points out) his chief reason for questioning it is today our principal reason for believing it: "namely, that in sailing around Libya they had the sun on their right hand." This is pre-

cisely what would happen in sailing south of the Equator: furthermore, the length of the voyage, the direction of transit (east to west), and the landing stages recorded, are all in accord with our present knowledge of ocean currents and trade winds prevailing around Africa.

With Alexander the Great exploration was a by-product of an overweening military ambition: to this restless forerunner of imperialism we owe our first knowledge of considerable areas in the Balkans, the Near East, Afghanistan and other regions to the north of India. Kashmir and the city we know as Amritsar were on his route, and he was making ready to explore the Ganges when his "soiled and tattered army" broke down.

An early astronomer, who combined an interest in scientific observation with "a desire to break the Carthaginian monopoly on

trade with the Atlantic coast" was first to unroll the map northward to the Land of Thule — thereupon the British Isles and portions of Western Europe were discovered. This was in 310 B.C. — but more than 2000 years passed before this early Marseillaise, Pytheas, received his due credit. One of the first in that noble band of scientific explorers, Pytheas noticed everything, systematically discounted the marvelous, and served Geography well. Mr. Outhwaite writes of his observations that they

are often apt and reasonable. In Cornwall he observes how the tin ore lies in the ground and how the miners dig galleries through the earth-veins that separate the ore beds. How they smelt the ore and form it into ingots "like knuckle-bones." He observes that the miners are friendly, gentle and intelligent, and says that this is probably due to the fact that their trade brings them in contact with a number of foreign people.

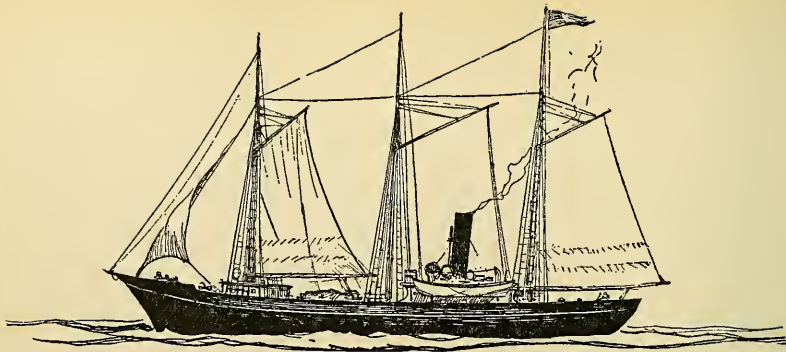
In view of England's colonizing genius and



KNOWN AND UNKNOWN NORTH AMERICA IN 1806

The famous 8000-mile journey of Lewis and Clark cut a swath through the blind spot of the West. The remaining

area in the United States was to become known soon after this period



PEARY'S VESSEL, THE "ROOSEVELT"

The success of Peary in 1909 depended in part upon the skillful handling of this sturdy ship under the command of Captain

Bob Bartlett. The "Roosevelt" specially designed to withstand the pressure of ice, was driven by both sails and engine

the stress laid by modern anthropologists on the cultural importance of contacts among peoples, the last statement reveals Pytheas as an exceptionally shrewd and honest traveler.

That Columbus "discovered" America in 1492 is one of those pleasant fictions which simplify the tasks of schoolboys. The Norse settlements at Vinland and Markland were established as far back as the Eleventh Century — and thereby hangs an extraordinary tale. "In 1898," to quote our author, "a Swedish immigrant named Olof Ohman was clearing up stumps in a wood lot near Kensington, Minnesota, when he pulled up the stump of an aspen whose roots were growing right around a rough-hewn stone." So far all is in order, but —

On the face of this stone were found twelve lines inscribed in a peculiar language. An indefatigable scholar, Mr. Hjalmar Holand, after more than twenty years of research, which involved forestry experts, geologists, linguists, and archæologists, has all but succeeded in proving that this inscription commemorates the settlement, in Minnesota, of a small colony of Swedes and Norwegians prior to the year 1362. It is believed that this is the same expedition which was sent by King Magnus Erikson in 1355 to "redeem" from paganism earlier Norse settlements in Greenland and on the continent. The missionary trail led westward through the unimaginable wilds of Canada and ended in the very region that was to become, more than five hundred years later, the "promised

land" of America's Scandinavian immigrants.

Skeptics may — and do — smile at this remarkable story. But, there is the "Kensington stone," and Mr. Holand's substantial, carefully documented volume to show, once more, the far-flung emprise of the Vikings.

No one people, however, has monopolized the pageant of exploration. Mr. Outhwaite's 300-odd pages are such a catalogue of ships and heroes as not even a Homer could fitly celebrate. Here are the Arabians, Soleyman and Ibn Battuta, who, in the dismal night of Europe, roam through Asia and India, missing little on the way, either of life or knowledge; Marco Polo, all eyes and wit and energy, discovers the vast Empire of Kublai Khan, and is set down a dreamer of dreams. Henry the Navigator inaugurates "the great age of adventure" during which Continents flower like gardens amid the deserts of man's ignorance: red for blood, yellow for gold, purple for the lust of conquest and the pomp of power. "Malacca Henry," a treacherous East Indian slave in the service of Magellan, deserves — insists Mr. Outhwaite in a curious footnote — the real credit for the first circumnavigation of the world attributed to his master: but Cortes, Cabeza de Vaca, de Soto, Pizarro, and their fellow Spaniards still have their "honors" in South and North America, despite many failures and cruel blunders.

As might be expected, Mr. Outhwaite gives generous space to the achievements of the

more famous explorers, although for each region he lists a number of the lesser-known but significant figures, thus giving to his narrative added value as a work of reference. Alexander von Humboldt, Darwin, Bates, and Wallace are liberally treated in the section on South America — but one misses any mention of the eccentric Waterton and the Nicaraguan scientist-explorer, Thomas Belt. In Asia the exploits of Vitus Bering help to explain the firm grasp of Russia on her eastern possessions, and there is a brief note on the classic geographic researches in China of the Baron Ferdinand Paul Wilhelm von Richthofen, followed by a useful chronology of exploration in Tibet. Nicholas Prjévalsky, "greatest of the Russian explorers" is duly honored for having been the first of the moderns to put Mongolia on the map, although earlier efforts had been made by the Jesuits, Huc and Gabet: today Roy Chapman Andrews has filled in many of the blanks left by Prjévalsky, particularly around the Gobi Desert — but there is no mention of Owen Lattimore, whose *Desert Road in Turkestan* is the record of a very notable journey.

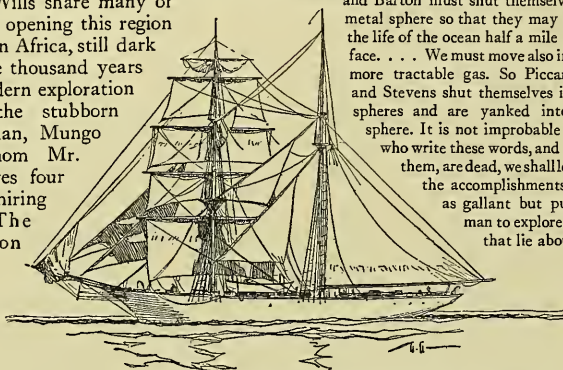
Arabia gives us the heroic Richard Burton, the rugged and compassionate Doughty, Gertrude Bell, and Col. T. E. Lawrence, that romantic adventurer who seems to spend his life avoiding the notoriety of his own quite deliberate actions. Australia and the whole of Oceania are still memorials to Capt. Thomas Cook, although La Perouse, Abel Tasman, R. O'H. Burke and his companion W. J. Wills share many of the honors for opening this region to the world. In Africa, still dark after some five thousand years of history, modern exploration began with the stubborn Scotch physician, Mungo Park — to whom Mr. Outhwaite gives four pages of admiring attention. The restless Burton

turns up on the Nile, whose headwaters he, with John Speke, proceeds to explore. David Livingston, of course, gets into the famous difficulties from which he was extricated by the American journalist, Henry Morton Stanley — and Africa was well on its way to becoming that colossal grab bag of imperialism later to be associated with the name of Cecil Rhodes — of whom, perhaps sagely, Mr. Outhwaite, gives no account.

The Poles, North and South, receive a hundred pages of vivid treatment, beginning with William Barents back in the Sixteenth Century and working down through a stately procession of valiant men to Peary, Amundsen, Stefansson, Captain Scott, Sir Ernest Shackleton, and the Americans, Byrd, Wilkins, and Ellsworth. A chapter on "The Pole by Air" tells the tragic story of Salomon August Andree, whose balloon carried him out of history one day in 1897; followed by brief accounts of the Amundsen and Ellsworth expeditions, of Admiral Byrd, and General Umberto Nobile's ill-fated "Italia" exploit.

Finally — [if we may conclude this sketchy outline of a notable book in its author's own words], finally, we are witnessing today a change in exploration which may be of the greatest ultimate importance. Exploration is moving from a two-dimensional to a three-dimensional realm. We no longer explore the mere surface of the earth. It is not an accident that man has launched himself into the air and moved beneath the surface of the sea just in that period of history when the whole surface of the earth has become known to him. . . . Beebe

and Barton must shut themselves in a heavy metal sphere so that they may see and sense the life of the ocean half a mile below its surface. . . . We must move also in a lighter and more tractable gas. So Piccard and Settle and Stevens shut themselves in light metal spheres and are yanked into the stratosphere. It is not improbable that before I, who write these words, and you, who read them, are dead, we shall look back upon the accomplishments of these men as gallant but puny efforts of man to explore the far worlds that lie about him.



FAMOUS NON-MAGNETIC SHIP "CARNEGIE"

ocean of the world contributed vastly to the knowledge of terrestrial magnetism and nautical science

Unique in the history of exploration, this vessel was built entirely without iron or steel. Her researches in every

Alligators of Georgia

Picturesque saurians that carry on a strange existence in their deep-water dens in the Okefenokee Swamp, despite threatened extinction at the hands of the hide hunters

By CHARLES NEWTON ELLIOTT

District Forester, Augusta, Georgia

NOWHERE else on the face of the earth does the sun grow as fat and lazy as it does in the Okefenokee Swamp at the harvest time of the year. The afternoons of late summer are peaceful and warm, filled with clusters of gold and purple leaves, brimming with that mysterious sense of something dreamy and quiet which compels one to slow the tempo of his existence and himself fall into a pleasant, dreamy mood.

It was just such an afternoon that we left the marshlands behind and turned our faces southward toward the coast. The Okefenokee lay behind us, the St. Mary's River ahead, moving majestically toward the Atlantic Ocean, one hundred miles away by watery trail.

We drifted along, unhurriedly, our eyes alert for early fall migrants, making low comments on the trees, the numerous birds, and the natural scenic beauty of this black-water stream. Our fishing rods lay in the bottom of the canoe, and a big bass, potential supper, drifted with lazy motions of his fins behind the stern, attached securely with a wire hook through his lips. We did not know or care about where we should camp for the night. The present was, in itself, sufficient.

Presently Stephens, in the bow of the canoe, dug his paddle into the small of my back.

"Look!" he whispered.

He pointed to one of the long, white sand banks which are usually exposed at that season of the year. A group of tiny alligators, basking in the mellow sunshine, lay checkered over its surface.

Stephens turned the prow of our craft shoreward and we glided quietly to the sand bank. The undersurface of the canoe rasped against the sand and the nearest baby alligator raised its head to look at us. Suddenly he

became alarmed and scampered for the water. The others, galvanized into action by his sudden move, followed. I shot out my hand and caught one of the tiny reptiles as it scuttled past the boat.

"Hold it," said Stephens. "I've got an idea that we might be able to entice this young fellow to call his mother to the scene. I'd like to see what she would do."

We stepped out of the canoe and pulled it ashore. Stephens held the young reptile aloft by its tail. It emitted a squeaking noise, much like an alarmed call for help. We stood there several minutes, but the mother did not appear to rescue her baby. Perhaps such things never occur.

We continued on our journey down the river and probably would have forgotten the incident, had we not, during the afternoon, found an old riverman fishing from the bank with a long cane pole. We stopped to talk with him and to get his ideas about the river, the wilderness, and life in general. During the course of the conversation, Stephens told him of our escapade with the young alligators and showed him the reptile we still held captive in the bottom of the canoe. The old man snorted at our seeming lack of intelligence.

"Lucky for you," he stated, "that the old lady was in the water instead of on the bank. You'd be shoveling coal now. Have you ever seen an old 'gator run?"

"Why, I thought they just crawled," I said. "I didn't know they could run."

I spoke untruthfully, because I wanted the old fisherman's version of an alligator's speed.

He snorted a second time.

"Kin they run?" he said. "I've seen 'em. They kin come b'ilin' down the river bank like a uprooted tree. I've seen one of the big ones, which are all gone now, knock a hundred-pound porker into the river with his tail, roll in on top of him, and swim off with him in his jaws. If that old she'd come a

pilin' down on top of you after her young 'un . . ." He snorted a third time, leaving to our own imaginations what might have happened.

Alligator is said to be a corruption of the Spanish name "El Lagarto" which means "the lizard," but in the biological order of all life, the alligator is almost as closely related to birds as to lizards.

An Ancient Type

Alligators might well have come down to us from the age of gigantic reptilia. Their plated armor, their bellowing voices, which may be heard on summer nights in the Okefenokee Swamp, their peculiar webbed feet, which serve them as well on land as in water, all make them capable of surviving under almost any environment. They have chosen the moss-hung cypress forests and the watery wastelands for their home. They love the solitudes, away from the haunts of man. Their appearance, their environment, seem to place them in a position where they would survive through the centuries.

Hide hunters, though, have taken heavy toll, and the last decade has seen the alligators fast disappearing in many sections of the south. A few years ago, when hides brought from \$2 to \$6 each, they were hunted day and night, and by every conceivable method known to man.

The hunter of the Okefenokee Swamp knows many ways of collecting these reptiles. A great number of the alligators in the Okefenokee make their homes on the "prairies," those treeless areas of water and floating earth, by cutting away the lily pads and roots and making deep-water dens, locally called "gator holes."

One of the most popular methods of getting skins is to hunt the reptiles at night with a light. The swamper pushes his boat noiselessly into the open water of the den and cuts on a powerful spotlight. He searches the fringe of marsh around the pool and presently catches, in the beam of his light, two ruby-red balls, which might well be living coals of fire. Using a high-powered rifle, the hunter drives a bullet between the eyes, or into one of them.

Sometimes alligators are hunted in the daylight hours. The swamper prods on the floor of the den with his long pole. When the reptile is located, it is jabbed in the back

with a barbed hook and brought to the surface. Another popular method of collecting hides is to catch the alligators on huge iron hooks baited with beef liver.

A few years ago one could not approach a "landing" in the Okefenokee Swamp without becoming nauseated at the terrible stench of decomposed saurian bodies. They were brought to the landings and skinned, and the bodies piled in a mass at one side. I have seen alligator bones stacked several feet high at the landing on Billie's Island.

Even now, when the market for hides is as far away as Germany, and when they are valued at less than a dollar each, the work of extermination goes on. Each year hundreds of hides are brought out of the Okefenokee and other southern swamps. The hunter has left the open water and gone back into the interior to take out skins, not only those of commercial length, but many too small to sell.

Larger Specimens Gone

Large alligators have become a rarity in the south. A ten-foot specimen is far above the average. The early explorers noted specimens thirteen feet long and longer. William Bartram, the naturalist who traveled through the wilderness of the southern states more than 150 years ago, made interesting observations on this reptile. Says Bartram:

My provisions being scanty, I determined to catch some trout for my supper. Not thinking it prudent to take my fusée with me, lest I might lose it overboard in case of a battle, I furnished myself with a club, went on board and penetrated the first line of those (alligators) which surrounded my harbor. They gave way, but being pursued by several large ones, I kept strictly on the watch. Ere I had halfway reached the place, I was attacked on all sides, several endeavoring to upset the canoe. My situation now became perilous to the last degree. Two very large ones attacked me closely at the same instant, rushing with their heads and parts of their bodies above the water, roaring terribly and belching floods of water over me. They struck their jaws together, so close to my ears as to stun me, and I expected every moment to be dragged out of the boat and devoured. But I applied my weapon so effectively about me, though at random, that I was so successful as to beat them off a little, and I made for the shore.

Bartram goes on to explain that the reason for the large number of alligators at this spot was the collection of fish in the pass of the St. John's River, where he was at that time. He says:

How can I express myself so as to convey an adequate idea of the prodigious assemblage of alligators to the

reader and at the same time avoid raising suspicions of my veracity? They were in such incredible numbers and so close together for half a mile from shore to shore that it would have been easy to have walked across on their heads had the animals been harmless.

These saurians give the impression of being slow on dry land. In the zoo I have seen them crawling on their bellies, with elbow joints drawn up behind them, level with their backs. They seem to have no other element but the water. This impression, however, is false. When he pushes his body away from the ground with his feet, an alligator can run like a lizard. I have seen leathery individuals on the Suwanee River, race twenty feet down a sand bank and splash into the water like a log thrown in, before I could reach into the bow of my canoe and pick up a gun. Once I chased a small alligator for fifty yards through the palmettos on the edge of the Okefenokee Swamp before I caught it.

An alligator's tail is much more formidable than his jaws, and he uses it to secure his food, as well as for fighting purposes. His jaws are built on powerful hinges, but all the power lies in closing, rather than in opening them. I have held shut with one hand the snout of a five-foot alligator while he struggled to break away, and I am no stronger than an average man. Probably the knowledge that if he did get those powerful jaws open near me, my natural physique would need patching, added a bit to the power of my grip.

Alligator vs. Bear

It seems that an alligator would be king in his element, the water, but old timers in the Okefenokee Swamp assure me that he is not. Lem Griffis and Dan MacMillan, guides extraordinary of the swamp, have convinced me that alligators will often attack bears swimming across a lake, and that in such an encounter, the alligator usually comes out second best.

Dan told me of seeing such an incident not long ago. He was fishing in the lower end of Billie Lake, when a bear came down to the edge of the water, slipped in, and started across. An old alligator, lying in the weeds, followed. In the middle of the stream, the alligator suddenly darted forward, seized the bear by his fur collar, and pulled him under. As they went down, Dan saw the bear turn

and rake steel-sharp claws at the face and shoulders of the reptile.

For a few seconds the water boiled where they had disappeared. The bear remained under the surface long enough to have been drowned, and Dan was about to resume his fishing, when the head of the bruin appeared. He calmly swam on across the lake, climbed out on the other side, and continued his interrupted journey over the half rotted logs and débris of the swamp floor, as though nothing had happened.

Dan also tells of killing an alligator in Chase Prairie. The saurian had half the meat torn off its face, so that its jaw bone was exposed. Big claws, obviously those of a bear, had ripped through the leathery hide of its belly. Dan was of the opinion that the same bear tore away the flesh of its face.

In the Okefenokee Swamp, alligators lay their eggs in big heaps of grass which they build up on one side of their dens. They construct this nest themselves, deposit their eggs, and then pull grass over the top of it. Turtles, in lieu of a soft, sandy beach, often follow them and lay eggs in the same nest, above those of the alligator.

The year 1931, when the big drought came to the southland and the water of the Okefenokee dried up to approximately 1 per cent of its normal volume, saw an appreciable decrease in both the bear and alligator population of the swamp. Hunters were able to travel into portions of the Okefenokee which had never been penetrated. They were able to locate alligator holes which were invisible in high water, drive out the saurian inhabitants, and take home many leathery scalps. Many times I found alligators traveling across dry country, seeking new homes when the one in which they lived had dried to baked mud. That same year, 114 bears were killed on the upper reaches of the Suwanee River, at one fishing camp alone. Alligators were taken out in proportionate numbers.

These rugged, picturesque old saurians have been preserved for us since time immemorial, and the species should not be allowed to face such a tragic climax, but civilization is constantly making inroads on their homes in the wilderness, and unless some action is taken for their preservation, they are doomed to extinction even in this generation.



Photo by Julian A. Dimock

'Gator Shooting

The alligators of the southland have become exceedingly scarce in many areas where their numbers were formerly legion. White hunters have sought 'gator skins for three hundred years and sportsmen have bagged countless thousands. The drainage of swamps has accounted for the death of untold numbers.

Mr. Charles Newton Elliott, author of the foregoing article, has spent many years in the investigation of the alligator in its native haunts. It is his opinion that the Okefenokee, or the "Great Swamp," should be set aside as a Federal preserve for wild life, thus protecting the alligator in this region.

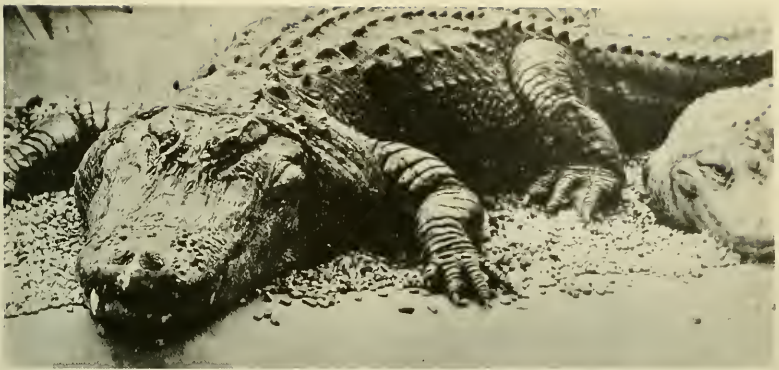


Photo by Julian A. Dimock

Above: The array of sharp, strong teeth in the alligator's capable jaws spells doom to many swamp creatures. The teeth may be shed as new ones push upward to take their places. One "crunch" of the huge jaws can easily destroy a dog, and the fate of ducks, geese, swimming marsh rabbits and other animals and birds, when caught by the 'gator, may well be imagined.

Below: This rude platform, supported by poles and cypress "knees," serves as a shelter for swamp hunters. Burlap sacking keeps out the wind, and slabs of corrugated tin form the roof. A number of similar camps are found throughout the Okefenokee. The hunter works all day in the swamp, and returns to the shelter at night to eat and sleep, often making his bed upon the ground.





Above: A strange thing about the jaws of the alligator is the fact that, despite their large size, they may be held together by a man with comparative ease. The enormous muscular power centered in the 'gator's jaws is used mainly in shutting the reptilian trap rather than in opening it. The large teeth of the lower jaw shut into pits in the upper jaw, instead of into marginal notches.

Below: A scene typical of the "Big Water" sections of the Okefenokee Swamp. In former years alligators were plentiful in this body of water. Today the visitor who penetrates the swamp for short distances considers himself fortunate if a 'gator is seen during the journey. In the deep interior of the swamp the reptiles survive in rapidly diminishing numbers.



Photo by Charles Newton Elliott



Photo by Charles Newton Elliott

Swamp's Edge

Above: Although 114 bears were killed in the big drought of 1931, the black bear is still seen in the Okefenokee country and hunters secure skins throughout the year. The swamp is so huge (640,000 acres) that many retreats for birds and animals still remain. The people dwelling in and near the swamp are by no means as de-

structive to wild life as are the visiting shooters. The elderly gentleman pictured above stands among the palmettos, on the lookout for game. He is a typical "swamper" who has spent a long lifetime in the region and who represents a vanishing group of true American frontiersmen gifted in the arts of woods-lore in all its phases.





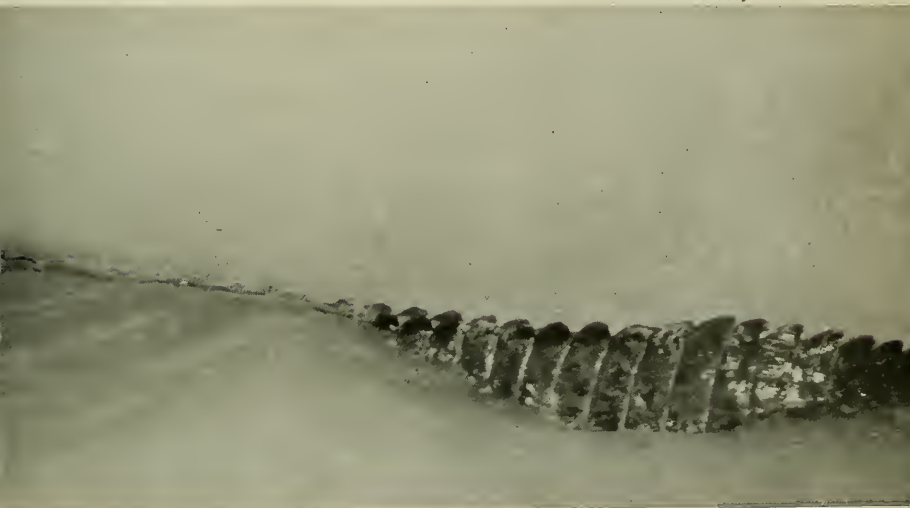
Photo by Charles Newton Elliott

Poling a "Run"

Above: The watery passages, threading the huge swamp, form the only means of approach to the interior where the hunter now goes to take out skins. Small, flat-bottomed, shallow boats are propelled mainly by long slender poles. The local swamp travelers invariably stand bare-footed upon the back seat and exhibit great skill

in guiding and pushing the clumsy craft. The patches of water lily pads, or "bonnets" as they are called, often impede the boat's progress. Nevertheless, a capable "swamper" can manipulate the prong-ended push pole in such a manner that the boat scarcely loses momentum as it is forced through the shallow water.

Photo by K. E. Webb



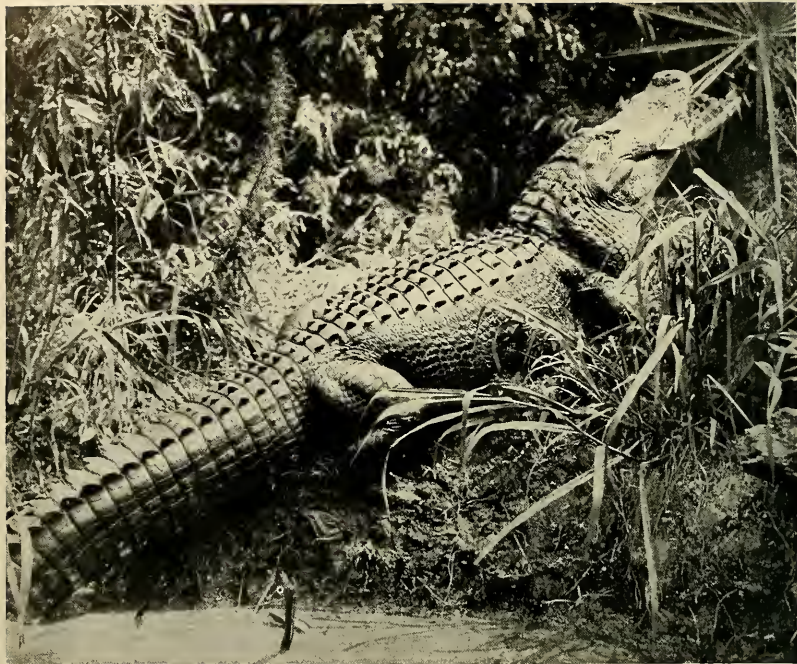


Photo by K. E. Webb

Above: This large fellow has succeeded in thoroughly discouraging a chicken. Despite the alligator's size and strength, there are few records to show that persons have been aggressively attacked. The reptile's first endeavor is to disappear as speedily as possible when man appears on the scene.

Below: From appearances it would seem that this young 'gator was investigating the automobile. Alligators sometimes travel overland from one pool to another. As a rule, however, they prefer the waterways. Individuals surprised ashore make a "bee line" for the water and dive in with a resounding splash.



Photo by Charles Newton Elliott



Above: Alligator "farms" have proved successful, especially in Florida, despite the slow process of raising the "product." The skins have many commercial uses, for the day of the "alligator bag" has not passed.

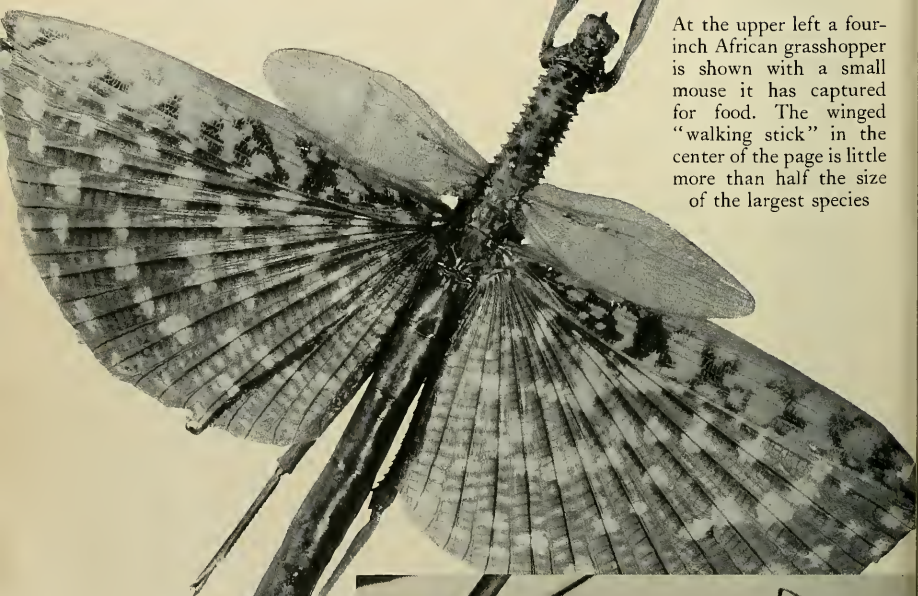
Below: Comparison between an alligator and a crocodile. The alligator on the left has a broad head, rounded at the snout, while the crocodile on the right has a pointed snout and a triangular head.



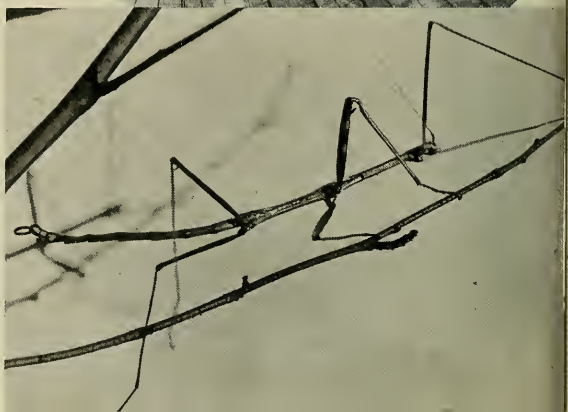
Photo by K. E. Webb



At the upper left a four-inch African grasshopper is shown with a small mouse it has captured for food. The winged "walking stick" in the center of the page is little more than half the size of the largest species



The "walking sticks" of the United States are long, slender, wingless creatures, closely resembling twigs



Insect Giants

Some members of the insect world which are interesting because of their huge size

By C. H. CURRAN

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AMONG most groups of animals it has been, as a general rule, the largest and most ferocious creatures that have created the greatest interest among men.

This interest is due in large part to the conceit and braggadocio that is an inherent part of man's nature. But it is not alone the size of the animal that induces man to search it out and slay it. There must be, in addition to bulk, no little element of danger to the hunter, due to the prowess of the hunted, and he must feel that he is matching his wits against a foe worthy of his mettle.

And even though man has perfected implements and a technique that greatly reduces the chances against his being the vanquished instead of the victor, the thrill of the sport still remains. Were this not so, the hunt for the elephant, the lion, the tiger, and other animals would today be such an insipid affair that it would fail to attract those sportsmen whose natures demand a thrill and to whom conquest gives real exultation.

In the case of insects a very different situation exists. It is not the largest insects that cause us the most trouble, but those of medium to small size. Few insects having a length of more than half an inch are dangerous to man or to his agricultural products, threatening his health or his crops, and few of those greater than this in length cause actual damage or are major pests.

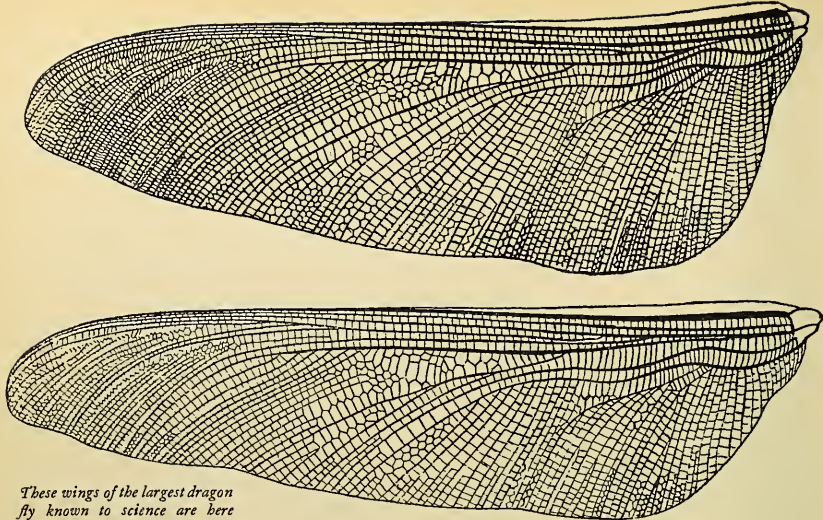
It is the injurious insects that come to our attention and, by their very abundance and usually unattractive appearance, cause many of us to ignore this dominant group of animal life, with the result that we never discover that there are many insects having a length as great as that of approximately twenty-five per cent of our birds—that is to say a length of more than six or seven inches.

Perhaps it would be as well to explain the methods of measuring these two groups of animals in order that the comparison may be better understood. A bird is placed on its back and measurements taken from the tip of its bill to the tip of its tail; an insect is measured by the length of its body, exclusive of appendages such as tail or antennæ, although some are measured by the wing expanse.

Large insects are, of course, giants among their kind, just as the elephant and whale are huge among the mammalian fauna, and as the dinosaurs were among the reptiles. Mention of the giant lizards brings to mind a parallel instance of huge size occurring among the insects of the distant past, and makes one wonder what tales man's predecessors might have woven if they had existed in a highly developed form at that time, about these invertebrate monsters of the air. Reference is made, of course, to the huge dragon flies having a wing expanse of up to thirty inches.

Today we have no dragon flies that can even approach in size those creatures that once soared over France, and probably other regions of the earth. If the belief, quite widely held among the uninformed, that our present-day dragon flies (sometimes called darning needles) will sew up the mouths of people, particularly of children who tell lies, has been engendered by observing the actions of the present-day insects, it is quite possible that the inhabitants of the world in prehistoric times might have had even more fantastic stories to relate about the largest insects of which we have any records.

Possibly some one may ask why these large insects have disappeared from the earth and why we do not have such large creatures today. The last part of this question may be answered first with the statement that we do have insects that are relatively as large as the extinct dragon flies, at least in length, although, their wings not



These wings of the largest dragon fly known to science are here reproduced only half their natural size

being large, we are unable to apply the same standards of measurement.

Now, to discuss the reason for the disappearance of the large Odonata before mentioning some of our giant living insects.

We cannot be absolutely certain of the causes of the decline in the dragon flies, but the probability is that the main reason was the lack of food. The creatures feed upon other insects in both the adult and larval stages. Since the larvæ of dragon flies are aquatic in habit, they were forced to feed upon the animal life in the ponds, lakes or rivers in which they lived, and the adults were forced to depend upon flying insects.

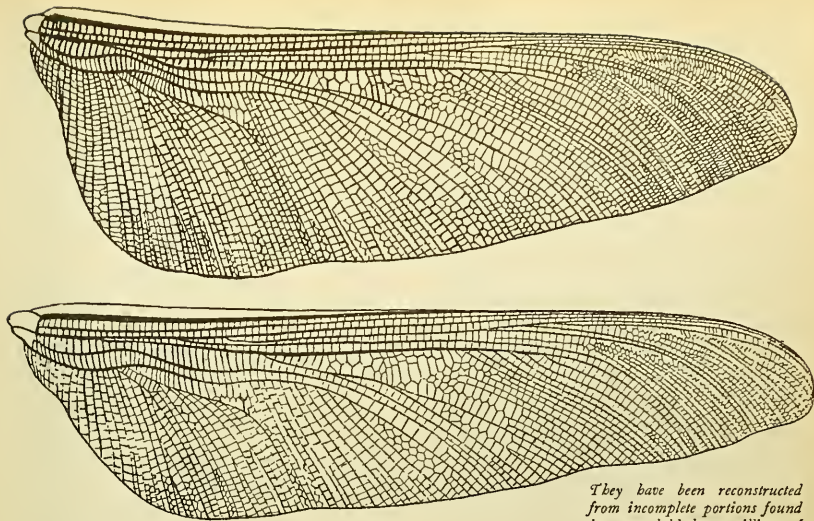
We cannot be at all sure as to the abundance of aquatic insects in those early days, but it is safe to say that both the larvæ and adult dragon flies made terrific inroads on the numbers of the very much smaller creatures upon which they fed.

The records do not give us any indication of other huge neuropteroid insects, whose larvæ are aquatic, and it is therefore evident that the huge nymphs of the dragon flies must have required an unbelievably large number of other nymphs in order to reach maturity and develop into the equally ravenous adults that spent their days skimming over the water, marshes, and hillsides in

search of prey. It is possible that the assumption that the inability to secure food was the cause does not accurately explain the decline of these insects, but there seems to be no other very good reason, unless some sudden and widespread change in climate was responsible.

Even today the number of large insects is small and very few attain a length of more than six inches. What is probably our largest one occurs in the East Indies and belongs to the group of insects known as "walking sticks," some of which must be well known to almost everyone, since we have one or two common species of this largely tropical group even in the United States and southern Canada.

In the natural order of things these insects are not far removed from the grasshoppers and, like them, are vegetarians. Some of them are entirely wingless, while others have functional wings as shown on p. 426, the lower wings being folded so that they lie concealed beneath the small, elongate, upper ones. The largest species measures a foot in length and has a breadth of two inches, being almost twice as long and decidedly broader than the species figured. It is a spiny creature and rather ferocious in appearance although entirely harmless.



*They have been reconstructed
from incomplete portions found
in strata laid down millions of
years ago*

There are several remarkable things about "walking sticks," not the least striking being their appearance. While at rest they often flatten themselves out along a twig, their front legs and antennæ stretched forward, the posterior four legs extended back. When disturbed, they move away with an ungainly gait, looking like nothing else in the world more than a walking twig—hence their common name. In flight some of them are quite beautiful since the lower wings are brightly colored in many of the species.

No one would be at all surprised to hear of a mouse eating a grasshopper, but the reverse would be considered rather sensational. Nevertheless, it is a fact and may be a more common occurrence than we imagine. In the British Museum of Natural History there is preserved a grasshopper about four inches in length, with its prey, a mouse of approximately two and one-half inches exclusive of tail. This specimen was received from Africa many years ago.

We regard grasshoppers and locusts as strictly vegetarian, but they have long been known to eat other insects, although none of them do so to the exclusion of vegetation. It is their destructive habits during their great migrations that bring them forcibly to our attention. It is said that in Africa the great

hoards of these insects feeding upon foliage make so much noise that they may be heard for long distances, and that large branches of trees are snapped off by the weight of their numbers.

One of our largest American species attains a length of five inches and has the thorax and front wings spotted with yellow, the posterior wings being reddish and black.

Few of the true bugs are of large size, although some of the Cicadas, erroneously called "locusts" by many people, are large and have a considerable wing expanse. One large Fulgorid may not be larger than some of the Cicadas but there is something fascinating about the bug. Its scientific name is *Fulgora lanternaria*, and it was so named because it was believed that it gives off a light. But it is no "lantern fly." It has been called "peanut bug" and "alligator bug" on account of the shape of the great head and because toward the lower edge of this part there is a row of markings on each side vaguely suggesting the mouth of an alligator. The adult and immature stages suck sap from trees and shrubs; the nymphs are copiously clothed with a waxy secretion, as is also the abdomen of the freshly emerged adult. It is not rare in tropical America.

Butterflies, because of their large size,

brilliant colors, and day-flying habits, are among the most commonly collected insects, and the impression is probably general that this group contains the largest of our six-legged creatures.

The Ornithoptera group of the genus *Papilio*, found chiefly in the East Indies, is conceded to contain the largest butterflies, the females of one species attaining a wing expanse of ten inches, although averaging less than nine. The males are much smaller and the usually brilliantly colored wings are of peculiar shape.

One unusual thing about butterflies (from the scientific, but not the popular standpoint) is that the largest species are the most sought after. Many of the Ornithopteras and Morphos are rare and very poorly represented in collections. This is partly due to the difficulty of capturing them, as they are often observed flying over the treetops, seldom coming close to the ground. Even when flying at lower levels, they are difficult to catch without injury to their wings.

Add to this the fact that some species are seldom seen in nature, and that many of the known species have never been reared, and some idea may be obtained of the reason why they are so highly prized by museums and sought after by private collectors.

Night-flying cousins of the butterflies

There are, of course, many large kinds of moths, the night-flying cousins of the butterflies. The atlas moth is a native of the Orient and, like most of the large silkworm moths, is not rare. The adults are attracted to light and may be reared easily from the egg, so that perfect specimens may be obtained without difficulty.

These large moths are not true silkworms and the manufacture of commercially profitable silk from their cocoons has never been satisfactorily accomplished. Their greatest value lies in their beauty and the pleasure derived by the thousands of people every year who rear them from cocoons and watch the wings of the adults develop from small, thick sacks, to the natural size of the fully mature moth.

Titanus giganteus is a well-named beetle, occurring in the Guianas, but an extremely rare one. Having a length of approximately seven inches and a width of almost two and one-half, it is a bulky creature. Unlike the

larger mammals it is almost unknown, our own museum containing more specimens of elephants than all the museums of the world do of this beetle. It may not be rare in nature, but when we consider that there have been many collectors in the northern part of South America who would have pounced upon such a prize, it seems likely that it is either rare or has very retiring habits. However, its relatives among the long-horn beetles in other parts of America are fairly common.

Another South American beetle, *Dynastes neptunus*, attains a length of seven inches, including the horns on the thorax, and since it is a thick-bodied animal, it is actually quite large. This species and its allies, together with the African *Megasoma goliathus*, belongs to the same family as the so-called Japanese beetle, a serious pest in the region lying between New York and Washington. However, the large species are not known to be injurious.

The flies and bees cannot boast any gigantic members. The largest fly is found in South America and belongs to a family having unusual wing venation. *Mydas coerulescens* attains a length of less than two inches and is apparently the largest representative of either of these two large and important orders of insects, many of which are so important in the control of insect pests and the pollination of flowers.

It is fortunate, indeed, that there are not a great many large insects and more especially that they are not serious pests. It is easy to imagine what would happen to the world if such pests as the potato beetle, the grain weevils, and others were even half as large as *Titanus giganteus* and were still possessed of their present destructive habits. On the other hand, their large size would make them more susceptible to the attacks of their enemies, so that it is probable that nature would be not at all disturbed and things would continue as they now are.

Only one thing can be said in favor of large size for insects, and that is, if they were larger more people would be attracted to studying them and thousands upon thousands of kinds as yet unknown to science would long since have been described. But then the entomologist would be denied the joy of peering into his microscope and discovering the beauties of structure and detail possessed by some of our microscopic species.

Nature's Sea Serpent

*An authentic history of the amazing "King of the Herrings"
and of his encounters with Homo sapiens*

By WILLIAM KING GREGORY

Curator, Living and Extinct Fishes, American Museum

LOCH NESS has its colossally successful "Monster" (with affidavits) and Vancouver its "Old Reliable," with eye-witnesses of rigid respectability. The human species (self-called *Homo sapiens*) being for the most part strongly mythophilous (as Barnum and many others have discovered), the market for bigger and better sea serpents is practically unlimited, but in a strictly scientific and presumably truthful Museum not so much can be done toward satisfying this demand. However, a Curator of Fishes may be excused perhaps for succumbing occasionally to the showman's urge and pointing with pride to one of Nature's own sea serpents, the King of the Herrings (*Regalecus glesne* Ascanius), which is known to attain the respectable length of twenty-one feet.

I am referring to this fish as Nature's sea serpent to distinguish him from Kipling's sea serpent, which was a damaged whale-shark, and from the Coast-of-Normandy sea serpent, which was a mutilated basking-shark, and from the Mauretania sea serpent, which seems to have been a pure *Chimaera bombitans in vacuo*.

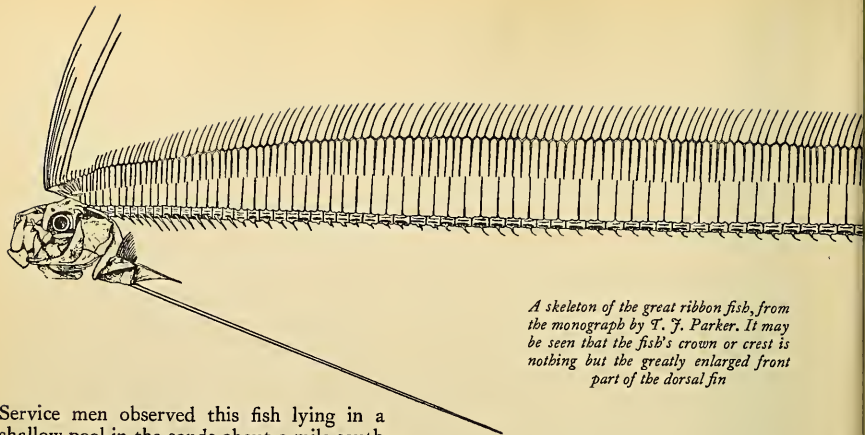
Unlike Doctor Beebe's *Bathysphaera intacta*, that monster of the great depths that tried to disturb the privacy of the bathysphere, the unfortunate King of the Herrings has been neither "untouched" nor "untouchable." Indeed he has had his crown messed up and his person lacerated with boat hooks on the rare occasions on which he has fallen into the profane, ravaging hands of *Homo sapiens*. Listen to this excellent "Account of a Ribbon Fish (*Gymnetrus*) taken off the coast of Northumberland" as reported by Albany Hancock and Dennis Embleton, M.D., in *The Annals and Magazine of Natural History*, Second Series, No. 19, July, 1849:

"On the 26th of March, 1849, a fine specimen of a species of *Gymnetrus* or Ribbon Fish,

was captured by Bartholomew Taylor and his two sons, the crew of a fishing coble belonging to Cullercoats. It was found at about six miles from shore, and in from twenty to thirty fathoms water. The men having started from their fishing ground to return homewards, observed at a little distance what appeared to be broken water; the old man being struck with such a novelty, directed his lads to pull towards it; on nearing the spot they perceived a large fish lying on its side on the top of the water. The fish as they approached it righted itself, and came with a gentle lateral undulating motion towards them, showing its crest and a small portion of the head occasionally above water; when it came alongside, one of them struck it with his picket — a hook attached to the end of a small stick, and used in landing their fish; on this it made off with a vigorous and vertical undulating motion, and disappeared, Taylor says, as quick as lightning under the surface. In a short time it reappeared at a little distance, and pulling up to it they found it again lying on its side; they plied the picket a second time, and struck it a little behind the head; the picket again tore through the tender flesh by a violent effort of the fish, which escaped once more, but with diminished vigour; on the boat coming a third time alongside, the two young men putting their arms round the fish, lifted it into the boat. Signs of life remained for some time after the fish was captured, but no doubt it was in a dying or very sickly state when first discovered by the Taylors."

But Hancock and Embleton report an even more dramatic encounter between *Regalecus* and *Homo*.

"We have lately been favoured with a letter from Mr. George Tate of Alnwick respecting a fish of this genus, from which we make the following extract:—'A fish was exhibited in January or February of the year 1845, similar in its general form to that, a drawing of which you showed me when I was last in Newcastle. One of the Preventive



A skeleton of the great ribbon fish, from the monograph by T. J. Parker. It may be seen that the fish's crown or crest is nothing but the greatly enlarged front part of the dorsal fin

Service men observed this fish lying in a shallow pool in the sands about a mile south of Alnmouth, where it had been left by the receding tide. Its great length and unusual appearance at once raised the man's curiosity and excited his fears. On approaching it, the creature bent itself round so as to appear like the rim of a coach-wheel, and the man, supposing it was about to dart upon him, drew his sword and struck it on the head. The fish struggled much, but the man striking it repeatedly at length succeeded in cutting off its head."

Thus the poor sea-king lost his crown and his head.

Naturally it is not until after all damage possible has been done that the local naturalist, if there be one, hears about the strange fish and hurries to the scene to study the sad remains.

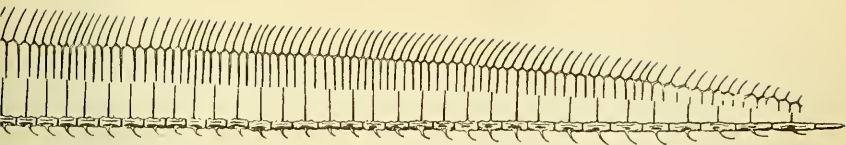
"It was exhibited the same day in Tyne-mouth, North and South Shields," write Messrs. Hancock and Embleton, speaking of the specimen captured by the fisherman in 1849, "and brought to Newcastle next morning. In the afternoon we first saw it; we found it much injured by the strokes of the hook and by rough handling during its removals and the examinations it had undergone. The fins were a good deal torn but the fish evidently quite fresh." And then these very competent naturalists got busy and made measurements, careful dissections and a host of precise and illuminating observations, which they later combined with a fine review of the scattered literature of the subject.

A half-century later at Newport Beach on the shores of southern California a giant oar-

fish came too near the abodes of *Homo sapiens*. A Mexican saw it alive in the surf and afterward claimed that he hauled it ashore. "Being ignorant of its value, he cut it up, bringing in a part of the scarlet fins and a slice of the flesh. This he showed to some men and led the way to where lay the mutilated remains of one of the finest oar- or ribbon-fishes ever seen. The specimen was twenty-one feet in length and its weight estimated at about five or six hundred pounds. The finder had so mutilated it that the fish was ruined for almost any purpose." So wrote Mr. C. F. Holder as quoted by David Starr Jordan (*Fishes*, 1925, pp. 684-686).

Another ribbon fish, a small specimen, was taken alive at Avalon Bay, Santa Catalina, in the same enlightened State, but "the fortunate finder of this specimen," writes Mr. Holder, "could not be persuaded to give it up or to sell it, and it was its fate to be pasted upon a piece of board, dried in the sun as a 'curio,' where, as if in retaliation at the destruction of so rare a specimen, it soon disappeared."

So far as I have been able to discover, only two naturalists have ever had the privilege of seeing a living King of the Herrings. Mr. Holder (quoted by Jordan, p. 685) states that on one occasion a small oarfish, "not over two feet in length, was discovered swimming in shallow water along the beach of Avalon Bay [Catalina Island, southern California]. I had an opportunity to observe the radiant creature before it died. Its 'top-knot' — it can be compared to nothing else



— was a vivid red or scarlet mass of seeming plumes — the dorsal fins, which merged into a long fin, extending to the tail. The color of the body was a brilliant silver sheen splashed with equally vivid black zebra-like stripes, which gave the fish a most striking appearance. The fish was a fragile and delicate creature, a very ghost of a fish, which swam along where the water gently lapped the sands with an undulatory motion, looking like one of its names—the ribbon-fish.”

In 1906, in the seas of the Indo-Australian Archipelago, Prof. Frederick Wood Jones (quoted by Weber and De Beaufort in *The Fishes of the Indo-Australian Archipelago*, V, Leiden, 1929, pp. 92, 93), who was the naturalist on board a steamer that was laying a cable, saw a living *Regalecus* in all its glory.

“On October 28th, 1906, 30 miles South of the Island of Sumbawa . . . whilst the ship was hanging on to its cable, at about 10 A.M. a long and very beautiful fish came to the surface at our bows and stood with its nose close to cable, just keeping pace with the current. Baited hooks were thrown to it but it took no notice of them. Attempts were made to hook it or catch it with a running bowline, but without success. Whenever it was touched by a hook or a rope, a crest of a fine red colour was erected from the head. This crest was nearly 3 feet out of water. The fish slowly sank again but appeared later in the morning again and was at last scrambled on board a boat . . . In the water the fish was a wonderful sight. The vivid red crest and dorsal fin, and the scarlet streamers of his sides, and the blue of his head and intense shine of silver of his body making him very beautiful in the clear water. His tail end was bitten off just behind the vent; the remaining head and body measured 11 feet 9 inches (3582 mm.), it weighed 140 lbs. (ca. 63 K.), the greatest depth was 13 inches (330 mm.).”

The various popular and scientific names

applied to our mysterious visitor from the depths refer either to some of its salient features or to its supposed habits. According to Shaw's *General Zoology* (1803, Vol. IV, p. 194): “This fish is said to be generally seen either preceding or accompanying the shoals of herrings in the northern seas, for which reason it is popularly known by the title of *King of the Herrings*.”

The generic name *Regalecus*, credited by Jordan (*A Classification of Fishes*) to Brünich 1771, is a combination of Latin *regalis* and *balec*, fish-sauce (herring). Jordan, however, calls the Regalecidae “Oar Fishes; Sea Serpents,” reserving the name “King of the Herring” for the Trachypteridae, a nearly related family of smaller fishes.

The name *oarfis* was given in allusion to the pair of very long, strong, and straight ventral spines, which terminate in small ovate expanded tips. “Ribbon-fish” obviously refers to the extreme lateral compression of the body, which in Hancock and Embleton's specimen was only two and three-quarters inches thick in a fish twelve feet, three inches in length and eleven and one-quarter inches in maximum height.

The Japanese fishermen, according to Jordan (p. 683), call our fish the “Cock of the Palace under the Sea,” in evident allusion to its brilliant recurved nuchal crest.

That the King of the Herrings may have contributed, along with other sea creatures, to the myth of the sea serpent was suggested by Hancock and Embleton (1849, pp. 15, 16) in the following passages:

“We have moreover learnt from a Norwegian captain who frequents this port and has traded to Archangel, that in the White Sea, fish closely resembling the Cullercoats one are occasionally seen, the silvery colour, long attenuated form, and rapid undulating motion being their chief characteristics. They are there called Stone Serpents.

"It has occurred at once to many here and to ourselves also on first viewing this *Gymnetrus*, that it may possibly have been taken for the famous Sea Serpent. The Archangel name of the fish seen there, strengthens the idea that it may at times have deceived the eye of some credulous mariner, from its rapid undulating motion, linear form, and from its occasionally appearing at the surface, and leaving a lengthened wake behind it, thus creating an exaggerated idea of its extent.

"On consulting however the accounts which have appeared of the Sea Serpent, we find that they relate in most instances to creatures widely different from the Ribbon Fish, such as whales, seals, sharks, etc., seen under disadvantageous circumstances or imperfectly observed. Still, though the *Gymnetrus* may not have originated the idea of the existence of a marine serpent, we think it not improbable that the occasional appearance of this fish may very materially have tended to keep up among the Norwegian fishermen that faith which they are stated to hold in the existence of such a monster."

In view of the extraordinary interest of the oarfish and in the lack of preserved specimens, which are excessively rare, we undertook some years ago to construct a life-sized model of the fish. For this purpose we selected the beautifully illustrated account of the external appearance, soft anatomy and skeleton of the New Zealand oarfish, *Regalecus argenteus*, as given by Professor T. J. Parker in 1884. This specimen was cast ashore at Moeraki near Otago, New Zealand, in June, 1883. It was twelve and one-half feet long, greatest height, fifteen and one-quarter inches, greatest thickness, three and one-half inches. Supplementary details were taken from other sources. The life-sized model was skilfully constructed and painted by Mr. Christopher Marguglio and is now exhibited in the inner room of the Hall of Fishes.

It would seem appropriate for the King of the Herrings to have a long pedigree of noble forebears, but unfortunately, Palæontology, which has supplied family trees for many less imposing personages in the fish world, has not yet revealed our hero's direct line of ancestry. Nevertheless, the proud king (not unlike *Homo sapiens* in this respect) bears in his own person some rather convincing evidences that his ancestors have not always worn a crown.

In the first place, his very crown or crest itself on close inspection is seen to be nothing but the greatly enlarged front part of the dorsal fin, and the fact that he can raise and lower this crest confirms the evidence of the skeleton that the slender rays supporting the crest are operated by erector and depressor muscles essentially like those in the dorsal fin of any yellow perch caught on a bent pin by a small boy.

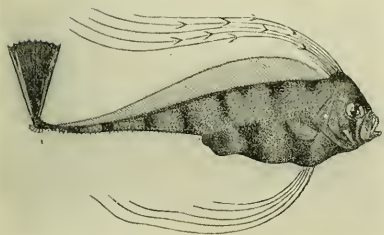
Those long and graceful "oars" on the under side of the body just behind the head are assuredly nothing but much specialized ventral fins; and the fact that they are fastened to the lower part of the collar-bone indicates that the King of the Herrings is one of the innumerable descendants of the ancestral "spiny-fin" of the Cretaceous period. These ancestral spiny-fins were not unlike the humble yellow perch in general build but with shorter bodies, rounded in side view, and a large, normal fish tail. Their mouths, supported by movable bony plates, were already protrusile.

The King of the Herrings is again like *Homo sapiens* in the fact that he has some poor relations still living who would no doubt cheerfully testify to his humble derivation. Of these the lowest in rank is a fish called *Velifer hypselopterus*, who would be an ordinary-looking fish if it were not for his enormous dorsal and anal fins. Simply by multiplying the segments of the body, short-bodied fishes have often been transformed into long-bodied ones, and in *Regalecus* the great similarity of one segment to the next indicates that this is exactly what happened. The early larval deal fish indeed represents an intermediate stage in this multiplication of bony and muscular segments.

Hancock and Embleton report the presence of ovaries in their specimen and T. J. Parker says that his fish was an adult female. It is evident therefore that there is little or no scientific support either for the Norwegian name "King of the Herrings" or for the Japanese "Cock of the Palace under the Sea." To judge by analogy from the known cases of extreme sexual dimorphism in some other deep-sea fishes, it would not be surprising if the mate of the fearsome Queen of the Herrings were some insignificant shrimp of a fish only a foot or two long and resembling the dealfish (*Trachypterus*).

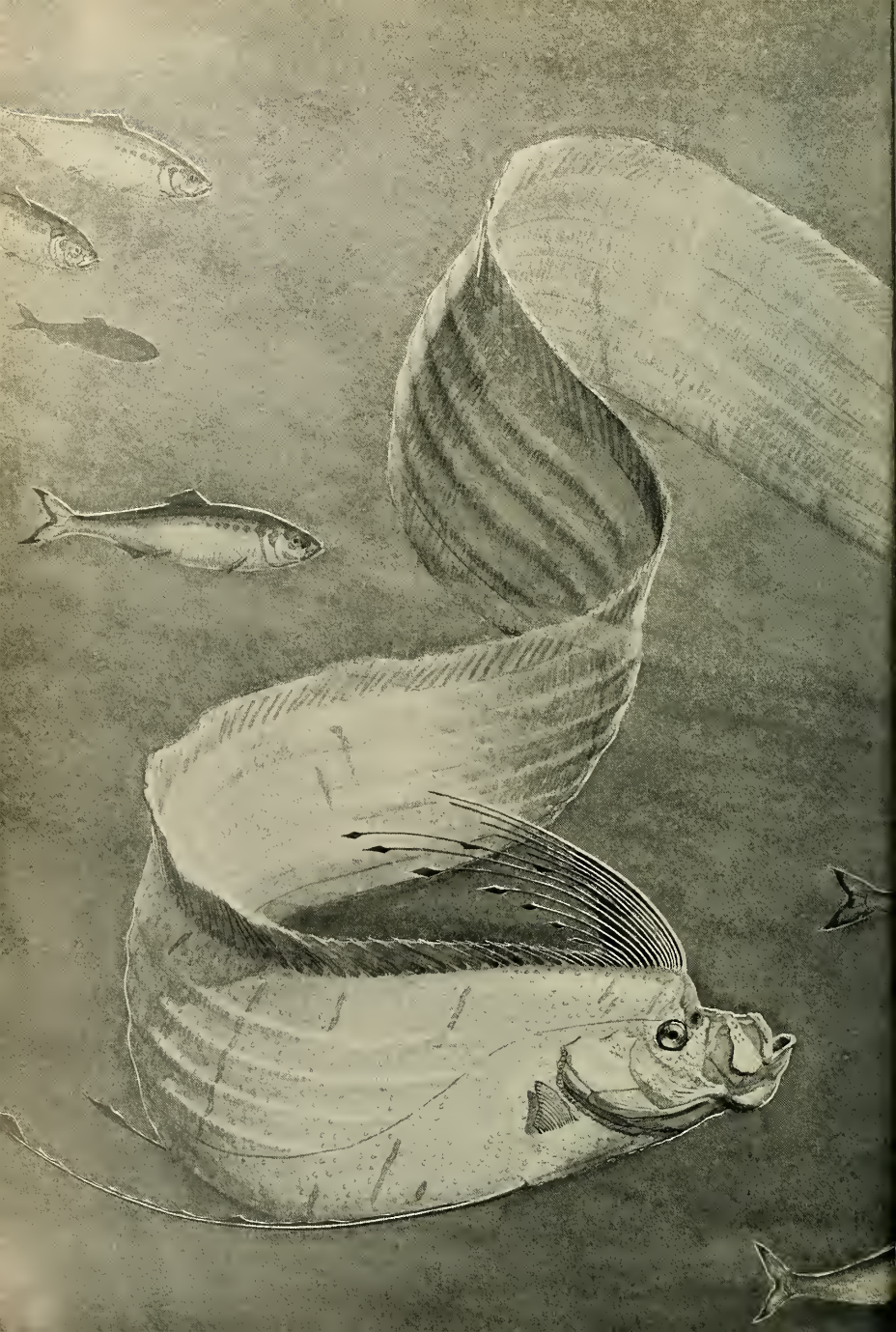
Sic transit gloria regis balecorum!

Oar and Dealfishes— Enigmas of the Sea



Above: Photograph of a model of the great ribbon fish on exhibition in the Hall of Fishes at the American Museum. *Left:* The larval specimen of a dealfish about six inches long. From Weber and De Beaufort. *Below:* A young "dealfish." This specimen, measuring nine inches in length (to tip of tail) was secured in Japan by the late Prof. Bashford Dean. Possibly this may be only the young or the male of the great ribbon fish







The "King of the Herrings"

Based on the specimen which was cast ashore near Dunedin, New Zealand, in 1883. This great ribbon fish was dissected and described in a beautifully illustrated memoir by Prof. T. J. Parker. It was $12\frac{1}{2}$ feet in length, $15\frac{1}{4}$ inches high, and at most $3\frac{1}{2}$ inches thick — whence the name "ribbon fish." The record ribbon fish, measuring "twenty-one feet and some inches," was cast ashore at Newport, California, in 1901.

Drawing by D. M. Blakeley

Science in the Field and in the Laboratory

*American Museum Activities, Expeditions, Education, Meetings of
Societies, and New Members*

Edited by A. KATHERINE BERGER

The Cover Painting for the May Issue

The cover of this issue of *NATURAL HISTORY* was painted by Mr. W. L. Kihn, and represents the monolithic statues of Easter Island described in Dr. H. L. Shapiro's article on pp. 365-377. Statues, similar to those pictured on the cover, are found on the inner and outer slopes of Rano Raraku, an extinct volcanic crater on Easter Island. They range in height from 10 feet to 40 feet, and one still unquarried, but roughly blocked out, is said to be well over 60 feet in length. Except for minor details, the many statues scattered on the mountain-sides are carved to the same pattern. Their boldly cut planes throw dramatic and effective shadows which from a distance give them a reality that on closer inspection they do not possess.

The American Museum — Sinclair Expedition

Through the generous coöperation of the Sinclair Refining Company, dinosaur work was continued this year over six of the Rocky Mountain States.

The dinosaur quarry on the Barker Howe ranch, twenty-five miles northeast of Greybull, Wyoming (second only in importance to the Dinosaur National Monument of Utah), was completed and a car-load of 144 large boxes of skeleton material was shipped to the Museum.

During the first investigation of this deposit in 1932, preliminary work indicated two large skeletons. In 1933 six feet of the overlying sandstone was removed — over an area 65 x 45 feet. In June, 1934, camp was established on the Howe ranch and during the season twelve people were engaged in the excavation.

It soon became apparent that instead of two skeletons there was a mass of skeletal remains interlocked and tangled in a manner difficult to unravel. The entire deposit was first carefully uncovered and laid off in three-foot squares, given numbers, and bones accurately drawn within the squares on the quarry chart. When the bones were hardened, plastered, and excavated, each bone was given its square number, thus making definite association possible when the bones are prepared in the laboratory.

At least 4000 bones were collected, mostly of large Sauropods and Ornithischian dinosaurs with a few carnivorous teeth, patches of skin and pockets of stomach stones. There are at least three mountable composite skeletons in this collection.

These dinosaurs are Jurassic in age and represent a northern fauna 300 miles north of previously described Sauropods with several genera and at least six species new to science. More than twenty individuals are preserved, the largest approximately fifty feet long, but

a *Barosaurus*-like species predominates, including one specimen with a delicate skull and jaws attached.

Although mostly broken in short sections, the bones are not badly crushed and are practically free of matrix — a condition that is of great importance in a collection of this magnitude. A force of five trained laboratory men can prepare the entire collection in three years.

As a result of the widespread publicity, thousands of visitors came during the summer from every State in the Union, some bringing information of value.

Arrangements had been made with the Sinclair Refining Company to supply an airplane which arrived September 1 and was used until October 16, during which time we flew 20,000 miles, making an aerial survey over Montana, Wyoming, South Dakota, Utah, Colorado, Arizona, and New Mexico.

The airplane opened up a new world of investigation, enabling me to trace strata and determine their relationship with a certainty not possible from the ground. We were equipped with twenty-four inch and ten-inch Fairchild aerial cameras and secured photographic records of great value.

Several new areas of extensive promising exposures were discovered in fields previously thought to be completely explored and these were immediately checked by ground survey.

New areas discovered by this method in Triassic, Jurassic, Cretaceous, and Fort Union strata will require at least three seasons for our field parties to explore completely.

Other important discoveries from this aerial reconnaissance are:

1. A quarry of dinosaur bones with twenty-five feet of bones exposed in the Mesa Verde formation (mid-Cretaceous strata in which occur the largest dinosaur tracks known and in which bones have not been found previously).
2. A fine ceratopsian skull and jaws in the Judith River formation.
3. A *Mosasaur* skeleton and a five-foot *Mosasaur* skull in the Pierre Cretaceous.
4. A new type of reptile (collected), Middle Triassic.
5. An unreported Meteoric Crater.
6. An unreported Ceremonial Way of Twelfth Century.
7. Several new oil domes. — BARNUM BROWN

Morden Expedition

Among the first few fishes sent by Mr. William J. Morden from Honolulu is a specimen of *Uraspis candens*, representing a genus allied to *Caranx* found about islands of the Pacific, and new to the collections of the American Museum. Fishes of this genus have the armature of the lateral line peculiar. They are somber-colored, with the large tongue and some space around it abruptly

white, contrasting sharply with adjacent parts when the mouth is open. The presumption is that this color character is correlated with some as yet unknown habit which they possess. — J. T. N.

Snyder Canadian Expedition

On April 6 Mr. George G. Goodwin, assistant curator in the department of mammals in the American Museum, returned after a trip to Northern Alberta to collect an adult wood buffalo bull in winter pelage. Mr. Goodwin left New York on March 3 and flew in a new giant Bellanca plane, one of Canada's greatest aircraft machines, from Wilmington, Delaware, to the Government Hay Camp near Fort Smith in Northern Alberta.

Accompanied by Mike Dempsey, forest ranger, he traveled two days out in the bush with dog teams to the range of the buffalo and hunted on snow shoes. The animals were extremely wary and difficult to approach at this time of the year. Travel was slow and tedious on the soft drifting snow, yet the buffalo ploughed through it at full gallop.

A big bull measuring 6 feet 7 inches at the shoulder was secured by Mr. Goodwin. One thing that struck him most forcibly was the splendid condition of the animal, despite the fact that it had endured a long, hard winter, and forage was buried four feet under the snow. The temperature during the trip ranged between 30° and 40° below zero, and the hide froze as it was peeled off the animal. As is usually the case, the kill was made at dusk, and the animal was taken care of by the light of blazing logs. A blizzard, raging at sixty miles an hour with blinding snow, lasted four days during the trip.

This expedition was a continuation of Mr. Harry Snyder's expedition last fall to secure two groups of

wood buffalo, one of which is to be mounted and donated by Mr. Snyder to the Victoria Museum at Ottawa.

The Hispaniola Expedition

Mr. William G. Hassler who is leading an expedition to Hispaniola on funds provided by Miss Maud Lewis Fletcher, writes that he has successfully landed his equipment in Haiti and is rapidly becoming settled near St. Marc. The expedition is provided with a ton and a half Chevrolet truck, which will make it possible to move rapidly from one part of Hispaniola to another. Although the American Museum has had several previous expeditions in Hispaniola, this is the first time a truck has been imported solely for natural history studies.

Amateur Astronomers Association

During the month of May the Amateur Astronomers Association will present the following radio talks over Station WOR, on Tuesdays at the usual time, 3:30 P.M.

May 7 — Subject to be announced — John J. O'Neill, Science Editor of the *N. Y. Herald Tribune*

May 14 — Recent Books on Astronomy — Marian Lockwood

May 21 — Mercury — Hugh S. Rice

May 28 — The Asteroids — Hugh S. Rice

The last two meetings of the Association for the current season will be held this month, Wednesday, May 1, at 8:15 P.M., being the Annual Meeting with election of officers. Astronomical motion pictures will be shown.

The Hayden Planetarium

As NATURAL HISTORY goes to press the stainless steel inner dome of the Planetarium is almost completed.



BUFFALO CROSSING THE SLAVE RIVER, CANADA

These animals survive severe cold with little apparent discomfort, and plough through the deep snow with great

ease. The temperature in the region frequently falls to 60 degrees below zero

The lower row of plates, with the cut-out of the sky line of New York City as seen from Central Park, is already in place. This sky line is not painted on the dome, as many people think, but is actually cut out of the stainless steel. In back of it is placed a black background which makes the silhouette stand out clearly. The dome still has to be painted its final white color.

Planet Notes for May

Venus continues to be the evening star in the western sky, setting about 10:30 at the middle of the month. On May 5 there is an interesting close conjunction between Venus and the moon, which in some localities will be an occultation. During May the planet Mars is in the constellation Virgo, near the bright star Spica. The fact that the two planets, Venus and Mars, are both in the evening sky at the same time, Venus in the west and Mars in the east, makes the heavens particularly interesting at this time. Jupiter appears later in the evening in the constellation Libra.

Phases of the Moon

May 2, New Moon; May 10, First Quarter; May 18, Full Moon; May 25, Last Quarter.

Astronomical Gleanings

The new star, Nova Herculis, which flashed into prominence last December, becoming one of the dozen brightest stars, has sunk below naked-eye visibility. On April 1st it suddenly went from mag. 4.5 to mag. 6, and since then has fallen to mag. 7. . . . The moon produces tides in the solid earth similar to those that it produces in the oceans, alternately drawing Europe and this continent together and pulling them apart. This continental shift, now verified, has a range of about 63 feet. . . . A new spiral nebula has been discovered so distant that its light has been traveling 500 million years to reach the earth. This spiral — for the moment — is the most distant object ever observed.

Experimental Biology

Dr. G. K. Noble recently addressed the biological seminar of Princeton University on the relation of the sense organs to the social behavior of reptiles.

Living Reptiles and Amphibians at the American Museum

The innovation of placing live reptiles and amphibians in the reptile hall of the American Museum has proved so successful that a semi-permanent installation has been made at the far end of the hall. Here specimens of striking biological interest will be displayed with a proper setting of living plants. The new greenhouse in the Museum serves as a source of supply for both living animals and living plants.

Appointments

At a meeting of the Executive Committee of the American Museum on March 21 Mr. Roswell Miller, Jr., was appointed field associate in the department of living invertebrates for the year 1935, in appreciation of his active participation in the expedition of the department of living invertebrates to the Bahamas in 1933, the collections made by him on his expeditions to the Society Islands in 1934, and his present purpose of

collecting and making observations of marine life in Jamaica during the current year.

A Flower Calendar for May in Bronx Park

For flower lovers in the vicinity of New York, the New York Botanical Garden is promising that spring wild flowers will be blooming about May 1, throughout the natural woods which border the Bronx River. A week or so later there will be dwarf iris and other spring garden flowers in special planting on the iris slope in the southeastern section of the Garden, also in the Thompson Memorial Rock Garden; and during the latter half of May the main part of the iris display will begin to come into bloom. It will be at its best about from May 28 to June 8. Japanese cherry blossoms should be in bloom about May 20, on a knoll in the northeast part of the grounds, and a few days later lilacs in a special border south of the Rose Garden just off Pelham Parkway. Of these there are several hundred bushes in eighty-five varieties.

During May and June the innumerable flowers in the Thompson Memorial Rock Garden will be making an unprecedented display. The aim of this rock garden is to show every possible variety of rock-garden plant in its most suitable situation, both as to culture and appearance.

Lake Malheur Bird Refuge

Federal administration of the Lake Malheur Bird Refuge in Harney County, Ore., will no longer be complicated by claims that lands within the refuge are owned by the State. A recent decision by the Supreme Court of the United States, says the U. S. Biological Survey, quietly title and rejects claims asserted by the State of Oregon.

Established in 1908 by executive order of Theodore Roosevelt, the Malheur refuge has been continuously administered by the Biological Survey for the benefit of ducks, geese, swans, and other water-loving birds. By laws passed in 1917 and in subsequent years, however, the State asserted title to the beds of navigable lakes, and declared all meandered lakes to be navigable. This included Lake Malheur although this lake has never been regarded as useful for navigation.

These statutes and claims based upon them so embarrassed the Biological Survey in its relations with the many settlers persistently cutting hay and grazing stock within the refuge that the Government brought suit in the U. S. Supreme Court against the State to quiet title to the lands.

A special master to whom the controversy was referred found that title to the area did not vest in the State under its navigability claim, and also that the United States had not abandoned any lands to the State because of the running of survey lines and the issuance of patents to adjacent lands. The Supreme Court, in an opinion delivered April 1 by Justice Stone, accepted these findings.

This decision, says the Biological Survey, will simplify administration of the refuge and will also clear the way for Federal developments in connection with the Bureau's program of wildlife restoration. With the recently acquired P-ranch holdings on the Donner and Blitzen River, a tributary of Lake Malheur, and with other lands being acquired there, the refuge will be part of a large area that will once again furnish an important annual contribution to the Nation's supply of waterfowl and other wildlife.

Reviews of New Books

Recent Publications for Those Interested in Nature

The Nature of a Bird's World. By Eliot Howard. Cambridge: at the University Press. New York: the Macmillan Company 1935. \$2.50.

IN THIS little volume Mr. Howard, who needs no introduction to students of bird behavior, brings together some of his observations on the activities of birds which he interprets in various ways. He objects to the term "instinct" as too often connoting an extraneous agent that impels the living organism to react in certain ways. Yet it may be doubted if this has caused much real confusion, and the reader may proceed with the book as an exposition of some very interesting instinctive actions of birds.

It is maintained that the seasonal changes in the gonads modify or alter the individual's responses to certain stimuli not always directly connected with sexual activities. Thus, a waterhen one day is seen to pick up nesting material, but only to drop it; a later day she may pick it up and start the construction of a nest which she does not finish, although she may go on to build other half completed structures; still later she returns to complete the original nest. Howard believes that a sensory stimulus, such as the sight of the building material, produces certain reactions which the bird is unable to carry through to completion until its physical condition has reached the proper stage. The nest must be finished when there are eggs ready to be laid in it, but not long in advance, and a nice timing may be the result of such conditioned instincts.

When certain activities are being carried on by the bird, each of these in turn may hold the field, during the duration of its own rhythm, as a "master reaction." This will not normally be upset by other reactions, although if the stimuli for these others are presented there may be one or more "false reactions" which are not completed. A false reaction may interrupt, for a moment, the course of the master reaction or may follow it; in the former case, it will not be completed, but in the latter case, it may itself become a master reaction. One form of behavior, however, is not the actual cause of the other. The author believes that the activity of one reaction may lower the threshold of the others so that the bird is made more sensitive to all stimulation. The form of stimulus received from objects extraneous to the body is thus in part determined by the body.

A bird's life appears to be partitioned among different worlds, such as the sexual world, the nesting world, the brooding world, etc., and each possesses its own reactions. Howard moved a nest of newly hatched young yellow buntings four inches from its original site; the hen fed the young and brooded them, though at intervals she visited the original, now empty, site. The nest was then returned to its original position, a second nest was placed beside it, the young were transferred to the second nest and blown eggs were placed in the original one. The hen abandoned the young and brooded the empty eggs in the old nest, being influenced, possibly, by the internal stimulus of habit rather than by the external one of the sight of her exposed young a few inches

away. With food in her beak, however, she fed the young in the second nest, but when they were fed, she was unable to brood them but returned to brood the empty eggs. The nesting site took command of the brooding instinct; the young, of the feeding instinct. When she brooded and when she fed the nestlings she appeared to live in different worlds.

Although a bird enters life able to do things which it never needs to learn, and could not learn, it does learn many things from experience, some of which would seem to bind it to a sort of ordered routine, although this routine is not permanently fixed. Repetition undoubtedly "teaches" the bird certain procedures which it may follow or attempt to follow, even under unfavorable conditions, but the bird continually meets new problems and, as these are overcome, new "pathways" are set up; thus, though they are remembered, the "learned" reactions do not become master ones and constant change is the order rather than constant blind repetition.

Touching on the favorite topic of "territory," the author finds that the duration, size, and position of territory are provided for in each bird's inherited organization, but shape is individual. The boundaries are determined not by preference for special kinds of objects, but rather by particular chosen landmarks.

These are but samples of the many observations made by the author in his illuminating volume. It is unnecessary here to mention all the facts and theories which he has presented, or to discuss any of them in detail. The interested reader will find many suggestive questions, even though he may not agree with all of the given answers. The book may be recommended as highly stimulating to all students of bird behavior.

—J. T. Z.

Infants of the Zoo. By E. G. Boulenger, New York: E. P. Dutton & Company, 1935. 144 pp. \$2.50.

THIS attractive book, written and illustrated especially for children, will also delight grown-ups who enjoy excellent photographs of young animals. Mr. Boulenger, in his foreword says:

"The charm of youth is so universal and so irresistible that it needs little elaboration. The judge and the felon, the prince and the pauper—all are equally likable in the cradle or the toddling stages of their careers. Much the same applies to the so-called lower animals. Some of the largest and most dangerous animals are so helpless and lovable in their early days, that the average man might well be excused for wishing to add them to his household pets."

In glancing through the pages of this book one can well understand that the young of certain "dangerous" animals might well appeal to those who wish to have wild pets in their homes. The young of the lion and of the tiger as presented in these pictures, would certainly seem to be outstanding "material" for home guests.

In operating our small zoo at the Bear Mountain Trailside Museum, we have long since grown to appreci-



A PLAYFUL TIGER CUB

One of the charming studies of young animals illustrating

E. G. Boulenger's new book "Infants of the Zoo"

ate the fact that infant animals usually attract far more attention than their parents. This is especially true in regard to the Virginia deer fauns, to young raccoons, and even to our young skunks. For this reason, as each spring advances, we endeavor to secure young animals for exhibitional purposes. We are never disappointed in the public response to our efforts. Recently there have been a number of children's animal picture books published, and Mr. Boulenger has reached the first rank.

The greater number of the mammal photographs are by F. W. Bond and D. Seth-Smith, who are to be congratulated on their photographic ability. The descriptive texts, accompanying each photograph, are interestingly written and contain useful information. One wishes that they might have been somewhat extended in length.

In addition to the mammals there are also pictures of birds, reptiles, amphibians, and fish. Here, once more, we have evidence of Mr. Boulenger's ability in presenting and describing youthful wild subjects. Perhaps the photograph of the crowned lap-wing chick is the most original.

We are certain that this book will be received gratefully by many persons. — W. H. C.

Tropical Fishes for the Home. Their Care and Propagation. By F. H. Stoye. Carl Mertens. New York, 1935. 284 pp. 167 plates. Price \$4.00.

Tropical Fishes and Home Aquaria. By Alfred Morgan. Charles Scribner's Sons. New York, 1935. 254 pp. Drawings and Photographs. Price \$2.50.

THERE is little choice between these two attractively presented handbooks for the amateur aquarist. They both contain the necessary practical information and advice about the set-up of tanks, problems of light, air, pH, diseases, as well as short discussions of some of the more popular or more interesting tropical aquarium fishes.

Mr. Stoye's book, *Tropical Fishes for the Home*, includes a classification of the fishes with which he is dealing, made by a leading scientific authority. It is copiously illustrated, but it is regrettable, considering the

way in which the black and white and color plates are massed at the back of the book, that there is no index to the illustrations. The greater number of his pictures have long been familiar to us through Rachow's *Catalogue* of 1927.

Mr. Morgan's book, *Tropical Fishes and Home Aquaria*, includes an explanation of scientific names and a directory of aquarium societies. His publisher has done well by him, both in the striking gold and green jacket of his book, and in the fine full-page reproductions of New York Aquarium photographs, many of which have also been familiar to us for some time through Coates' 1933 book on the same subject. The drawings in the Morgan book are not so happy, betraying a lack of knowledge of the external anatomy of a fish, particularly around the head and mouth parts and the lateral line, which features are important in classification. This is rather inexplicable in view of the author's twelve-page discussion on the "inside and outside of a fish" in the beginning of his book.

The "blurb" on the jacket of Mr. Morgan's book, for which I suppose he should not be held altogether responsible, is rather misleading in its implication that this is the first book of the kind, which is by no means true.

The two books are of about equal length, but Stoye gives information about a greater number of species, and his book leaves the impression that either he has put in more hard work in its preparation, or knows more about the subject. Both books dwell rather too much on color descriptions, at the expense of practical advice or information. As handbooks, both are somewhat too long, and Mr. Stoye's book is insecurely bound.

Any amateur who is taking up this hobby to any extent is bound to get his most valuable information through conversation or correspondence with other amateurs, dealers, and professional aquarium men. He can buy one good book which will give him general directions and a few hints about what is desirable and why, and can gather the rest of his information from his own observations, plus the above sources. Or, he can buy all the books available, any one of which necessarily repeats some of the information to be found in

those of an earlier vintage. In the latter event, unless the last three or four years are no forecast of the future, he will eventually have quite a good-sized library on this fascinating subject.

This feature that remains to be included in one of these books is a series of really good, accurate drawings. The drawings and color plates used by Rachow and in the *Blätter für Aquarien- und Terrarien-Kunde*, and the New York Aquarium photographs have nearly all been used at least twice, and all have been copied, with or without acknowledgment, more than twice. Drawings showing the diagnostic characters correctly, as well as the beauty of the fish, would be not only ornamental to the book, but of real use to amateurs, professionals, and systematic ichthyologists. — F. LAMONTE

Identification of the Commercial Timbers of the United States. By Brown, Harry P. and Alexie J. Panshin. McGraw Hill Book Company, Inc., New York, N. Y.

THIS book of 223 pages is evidently intended as a practical guide to the woods as found in commerce, rather than as a text book, such as Record's similar volume evidently is. In the introductory pages, the discussion is rather technical, and the glossary at the back will need to be frequently consulted. Further, the authors give less weight to odor and taste than the review, and the keys to naked-eye identification do not emphasize the characteristic odor of thread spools in birch, the equally evident smell of white pine, and many others. In cypress this is so pronounced that a fossil specimen was easily identified without close inspection by its odor — and it was thousands of years old! But the anatomical keys, to both gross characters and minute ones, and the very fine illustrations accompanying them, with the detailed descriptive text for each species, more than make up for these omissions, and the sources of smell and taste are so variable in different individuals that perhaps the authors are wise in keeping to more generally dependable characters for sure identification.

The book is a thoroughly practical one and will fill a real need. — FORMAN T. McLEAN, New York Botanical Garden

Men, Mirrors, and Stars. By G. Edward Pendray, 339 pp., Funk & Wagnalls Co., \$3.00.

MEN, Mirrors, and Stars is a book written by a man who feels, and who is able to impart to the reader his feeling, that the story of the conquest of space by astronomers is a thrilling epic. Mr. Pendray is the science editor of *The Literary Digest* and the president of the American Rocket Society. In this book he tells the history of the making of astronomy — one could truly call it that — the history of man's efforts to create instruments, and the story of the instruments themselves which have enabled man to discover more and more about this universe in which he lives.

Men, Mirrors, and Stars is divided conveniently into three main sections — the first on "How Men Became Acquainted with the Universe," the second on "Revealing the Instruments that Reveal the Stars," and the third on "Modern Men and Modern Mirrors." Then, in addition, there are two valuable appendices which list the world's largest telescopes and their locations, and the more important of the modern observatories in North America and the Southern Hemisphere, with their equipment and staffs. These appendices are particularly useful, because such information as they contain has been most difficult to find collected in handy form.

The first section deals with the subject of the early instruments which men used in studying the stars, the invention of the first telescopes, and their development through the years. In fact, this section takes the subject through to the time of the modern telescope and today's developments. The second section deals with the construction and the principles of the telescope of today; it gives you the story of the message of light in a fascinating form, and as simply as possible; it tells you the story of the "modern art of making telescopes," and describes also the instruments which supplement and measure what the telescope sees for us. The third part deals with the telescopes of today, — introducing you personally to these wonderful instruments and to their famous makers. Here you meet intimately such people as Alvan G. Clark, John A. Brashear, and Prof. Y. W. Ritchey. You read the story of the great 200-inch which is now being built, the mirror for which was but recently poured at Corning, N. Y. You learn what astronomers hope for from this great new eye that is to peer out so far into space. And then, of course, as one would expect from a man like Mr. Pendray, who, in his work on rockets, has been so occupied with thoughts of the future, there is a chapter on what we may look for in the way of greater developments, both in instruments and interplanetary travel. This book also contains many practical and helpful suggestions for amateur owners of telescopes. — MARIAN LOCKWOOD

Holiday Shore. By Edith M. Patch and Carroll Lane Fenton. The Macmillan Co. New York. \$2.00

THIS is a seaside natural history for children. It is attractively gotten up and the text is adapted for the youngsters who are likely to be playing around between the tides during summer vacation times on either the Atlantic or Pacific coasts of the United States. It is full of information which will answer the questions occurring to the minds of young naturalists. It is well illustrated by photographs, many of which were furnished by the American Museum of Natural History, and by excellent drawings by Doctor Fenton. A number of the photographs, and also of the drawings, were made from details of the invertebrate groups in the Darwin Hall of the Museum, so that the book forms an excellent supplement to the exhibits in that hall, adapted to the use of the juvenile visitor. Most of the information is quite accurate; the most noticeable mistakes, to the reviewer, are the following:

The caption for the illustration on page 3, which is entitled "The Pink Jellyfish," is incorrect. The illustration is drawn from a model of the *Dactylometra quinquecirrha*, which is found from time to time along the coast and especially in the upper reaches of Narragansett Bay. The popular name "pink jellyfish" is applied to *Cyanea arctica* and it is obvious from the text that this is the jellyfish referred to. It occurs in vast numbers along the New England coast in the latter part of the summer, together with the white jellyfish, *Aurelia flavidula*. The former of these two species is the one which is so bothersome to swimmers, and its appearance is very different from that illustrated in the book. It is unfortunate that this should not have received emphasis, rather than the much rarer *Dactylometra*, as it is the species which the small wanderer by the seashore should strive to avoid.

The illustration of Sepia, the cuttlefish, was made apparently from a preserved specimen, as in life the two long tentacular arms are retracted into pouches,

Recently Elected Members

SINCE the last issue of NATURAL HISTORY, the following persons have been elected members of the American Museum:

Benefactor

Mr. Arthur Stannard Vernay.

Associate Benefactors

Doctor Harvey Bausler.
Mr. Templeton Crocker.

Fellows

Messrs. William D. Campbell, Lamar Hardy, William Procter, David Rockefeller.

Honorary Life Members

Misses Ida Richardson Hood, Mabel Rice Percy.
Messrs. Cass Canfield, Thomas Davis, Robert Johnson, Arthur Page.

Life Member

Doctor Felipe Ovalle Q.

Annual Members

Misses Leo Frenkel, J. H. Van Alstyne, Robt. N. Warmack.
Doctor Henry James.

Messrs. Lewis A. Beardsley, Arthur L. Cone, Jr., A. M. Fellows, E. H. Foster, Langdon Roosevelt Geer, Ralph W. Gwinn, E. Sperry Lea, Thomas James Lengyel, Roy M. McKeljohn, Vernon Moore, John Patton Oden, Albert H. Smith, William H. Stuart, Walter F. Wells, M. O. Williams, W. Howard Wise, William H. Wright, Jr., Rudolf Zimmer.

Associate Members

Misses Vinnie Ream Aborn, Jos. F. Adelmeyer, Durand C. Alexander, Milton Alpern, Gladys F. Anstutz, Christian S. Andersen, Viola P. Anderson, J. Winthrop Andrews, Maund Haskell Antholz, W. S. Applegate, Frank J. Argeringer, Curtis Arnen, W. H. Arnold, Gertrude Atherton, Gertrude B. Austin.

Sara L. Bach, Alfred Baldwin, Blaise L. Banberg, Mary E. Barker, Elizabeth Coyle Barber, Pauline A. Bashkowitz, R. A. D. Beatty, J. K. Bedell, Louis R. Bennett, Wray A. Bentley, Margaret C. Berardinelli, Alice D. Bernalthal, Eva Berkowitz, H. Lurie Berlin, T. Howard Biddy, Sam Byrdorf, Hannah Bjorlin, J. R. Blackstock, Bessie M. Bloch, R. W. Blosser, Mabel F. Bogart, Edward H. Booth, Aimee Bournat, E. J. Brandt, Mary Warren Brenton, Charles Brickell, Albert M. Briggs, V. May Bristol, Goudyloch Saffold Browne, S. B. Browne, Dorothy Burnham-Rose, Virginia B. Burr, Nellie E. Byrne.

Murray A. Cain, Henrietta A. Campbell, Mary R. Carey, Alice M. Carpenter, Barbara J. Carpenter, M. Estelle Carter, Xenia Casement, Alice W. Chapman, Daniel K. Chapman, Fred D. Chapman, J. Crosby Chapman, Harry R. Chubb, Chas. Dorothy K. Chute, Charles Huber Clark, Cyrus Clark, Warren A. Clark, J. L. Cleveland, Jr., Paul E. Coil, A. D. Cole, Juliet A. Cole, Spencer Allen Collom, Sr., L. R. Combs, C. A. Conard, Hulda R. Conklin, Chesley W. Cook, Edward M. Cook, Harris A. Conell, Nellie B. Corrigan, Frank S. Cragin, Mary Heine Craggs, Miner D. Cray, Marian M. Crowley, J. E. Cummings, Andrew C. Cunningham, A. C. Curtis, W. L. Curtis, J. E. Cushing, Evelyn Roeding Cuttle, W. S. Davidson, C. L. Davis, Emma J. Dawson, John Henry Dean, Frederick Deane, Olivette P. Dennison, John D. Dershuck, Ethel E. Deutsch, Walter A. Dew, Adelaide De Zoller, Mary Little Dice, Erna R. Dixon, C. E. Dodd, A. Wilson Dods, H. W. Dorsett, Fred B. Dunn, William McKee Dunn, Aveline A. Dyer.

L. B. Edwards, Pearl Huber Elsner, Charles A. Emise, Ethel I. Englund, Mary C. Ewing, Thomas Ewing.

John L. Farwell, Louis M. Faulkner, Mary Van E. Ferguson, Grace D. Fessenden, Jean S. Finney, Gertrude F. Fleming, Waldo E. Forbes, Aldyth C. Fox, Vivien P. Frank, E. F. Fredericks, A. R. Frostenosen, Otto W. Fuhrmann.

Ella L. Galloway, Cary B. Gamble, Lilian Garis, Laura C. Gilbert, Lucretia C. Gilbert, Eloise H. Gill, Edmond Giraud, Leonore Rothschild Glanzer, Gussie A. Gloschen, Rae S. Goldberg, Benjamin Goldwasser, Elizabeth Winter Gomme, Cornelia K. Goodrich, W. C. Gough, Goldie Beck Gould, Boyd Graham, Frances P. Graham, E. St. J. Greble, Arue A. Gregor, Flora B. Grimm, Etta Gross, Frances L. Grover, Donald H. Guibord, Nannette Naeve Gundlach, Waldo L. Gundlach, Helen F. Guth, Charles Lewis Guy.

James Hain, Edward W. Hall, Z. D. B. Hallett, Dorothy S. Halpern, James Hamer, Margaret M. Hammerschlag, H. W. Harding, Frank P. Harman, Perry Williams Harvey, W. K. Hatch, William H. Hay, W. E. Hayward, A. M. Helyar, Marjorie Henninger, Selma B. Herman, Clifford K. Hetherington, Baylor Ormsby Hickman, Harriette W. Hight, H. H. Hill, Jason Hixman, Lydia Hirschfeld, F. L. Hisaw, A. F. Hixson, Charles R. Hoiges, John S. Holbrook, Susan F. Hols, Howard P. Homans, H. B. Hostetter, Henriette L. Howarth, Harold G. Hull, Wm. F. Husenbittel, W. D. Hyatt, Lidie L. Hynson.

Ethel F. Imah, R. J. R. Irving, Walter Irving.

A. D. Jack, Thomas W. Jackson, Jr., John Jellen, Elizabeth S. Jennings, J. W. Jenison, Elizabeth Johnson, Alva Johnston, Joseph E. Johnson, Jr., Josephine C. Johnson, R. P. Johnston, Thomas T. Johnston, G. H. Judd.

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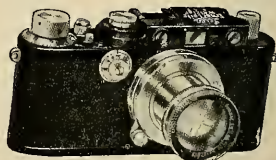
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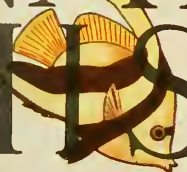
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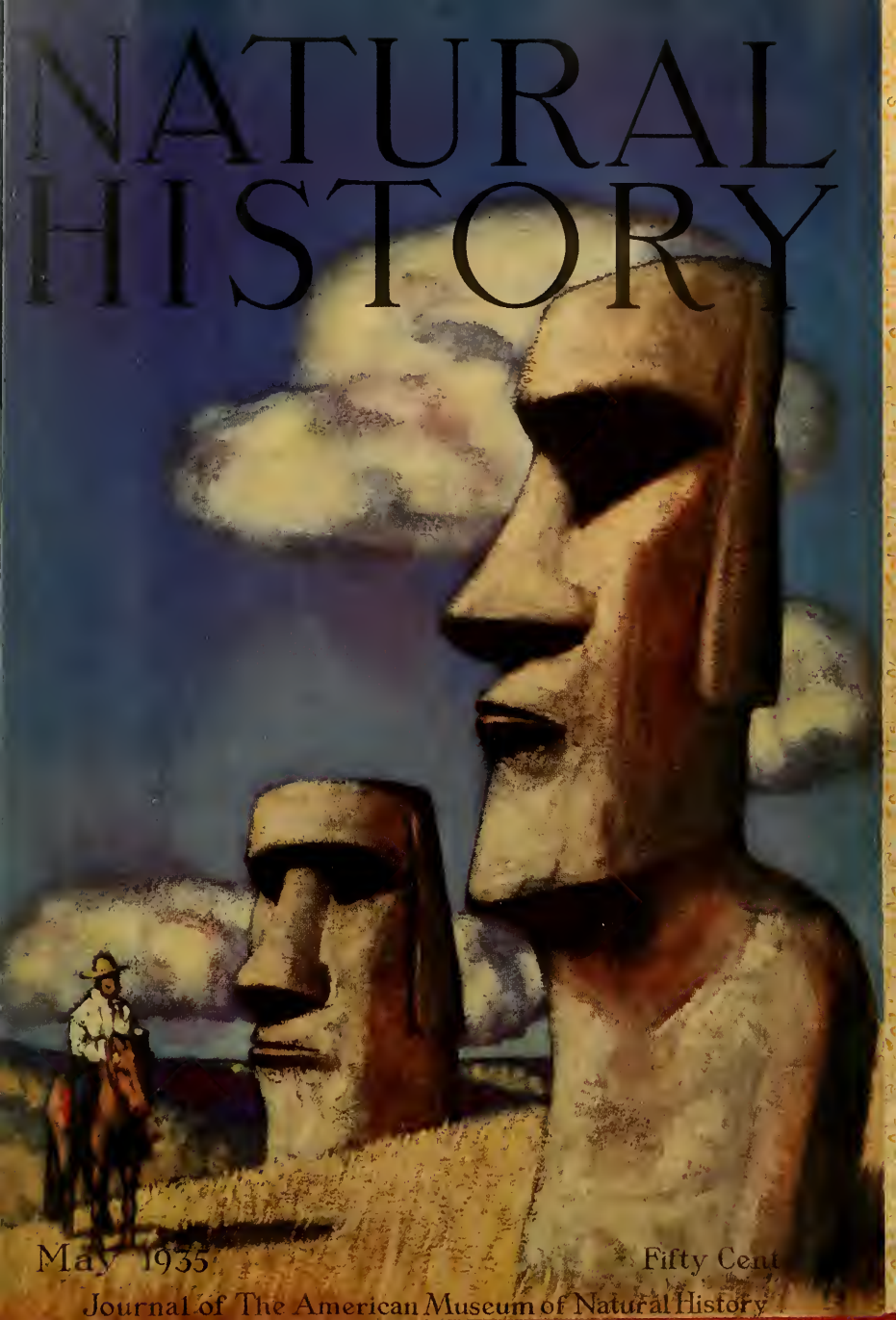
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